

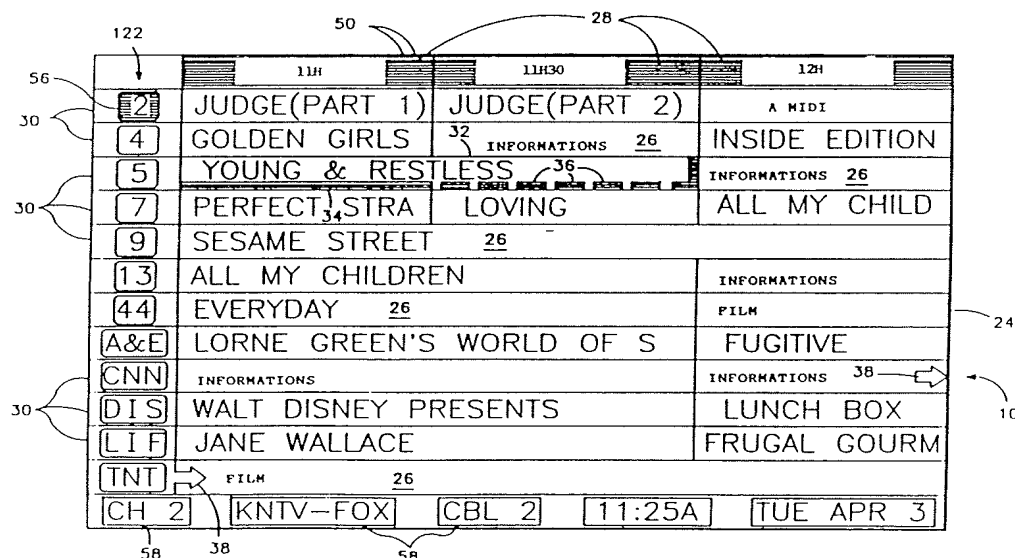


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(21) International Application Number: PCT/US91/06367 (22) International Filing Date: 10 September 1991 (10.09.91) (30) Priority data: 579,555                      10 September 1990 (10.09.90) US (71) Applicant: INSIGHT TELECAST, INC. [US/US]; 285 Hamilton Avenue, Suite 260, Palo Alto, CA 94301 (US). (72) Inventors: YOUNG, Patrick ; 1496 Cherrywood Drive, San Mateo, CA 94403 (US). ROOP, John, H. ; 3511 Cowper Street, Palo Alto, CA 94306 (US). EBRIGHT, Allan, R. ; 16121 Wood Acres Road, Los Gatos, CA 95030 (US). FABER, Michael, W. ; 833 Abbie Street, Pleasanton, CA 94566 (US). ANDERSON, David ; 534 Bush Street, Mountain View, CA 94041 (US).			(74) Agents: CHICKERING, Robert, B. et al.; Flehr, Hoh- bach, Test, Albritton & Herbert, Four Embarcadero Cen- ter, Suite 3400, San Francisco, CA 94111-4187 (US). (81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European pa- tent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (Euro- pean patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent). Published With international search report.

(54) Title: USER INTERFACE FOR TELEVISION SCHEDULE SYSTEM



## (57) Abstract

Screen (10) for a user interface of a television schedule system and process consists of an array (24) of irregular cells (26), which vary in length, corresponding to different television program lengths of one half hour to one-and-one half hours or more. Because of the widely varying length of the cells (26), if a conventional cursor used to select a cell location were to simply step from one cell to another, the result would be abrupt changes in the screen (10). By restricting cursor movements to the regular cells, abrupt screen changes will be avoided. A conventional offset shadow (34) which is a black bar underlines the entire cell and wraps around the right edge of the cell. To tag the underlying position which defines where the cursor (32) is and thus, where it will move next portions (36) of the black bar outside the current underlying position are segmented, while the current position is painted solid.

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## USER INTERFACE FOR TELEVISION SCHEDULE SYSTEM

## BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to a system  
5 and process that allows a television viewer to access  
on screen television program listings and use the program  
listings in an easy and convenient way to control  
operation of a video cassette recorder (VCR) or other  
recording device. In addition, it relates to such a  
10 system and process that creates a directory of recorded  
programs by title for easy retrieval and program  
playback. More particularly, it relates to such a system  
and process in which the VCR or other recording device  
is controlled by a simple selection of program title and  
15 a record command, even for recording at a future date  
and time. Most especially, it relates to such a system  
and process incorporating an intuitive user interface.

2. Description of the Prior Art:

The difficulty of setting a VCR for automatic  
20 recording at a future date is notorious. Even users who  
are technically sophisticated will often make mistakes  
in the VCR programming procedure that cause them to  
record the wrong program or not to record anything at  
all. This difficulty has even resulted in a substantial

body of humor dedicated to the subject of programming VCRs.

The difficulty of VCR programming has been alleviated somewhat by the development of VCRs that use a television set as a display for user prompts and feedback to the user during the programming process. U.S. Patent 4,908,713, issued March 13, 1990 to Michael R. Levine, discloses such a VCR using the television set as a display for VCR programming with an interactive user interface for directing the user on a step-by-step basis. Such a user interface removes a great deal of the mystery from VCR programming, but users still have difficulty with such a command-based interface and encounter problems carrying out the programming without making mistakes that cause them to miss recording programs they would like to watch at a different time than when they are broadcast.

Commonly assigned U.S. Patent 4,706,121, issued November 10, 1987 to Patrick Young, discloses a system and process in which user selections from television schedule information are used for automatic control of a VCR. That patent also contains a description of a proposed user interface for such a system and process. However, the provision of a highly intuitive user interface that makes such a system and process easy and convenient to operate is a difficult task. Further development of this system and process has produced considerable change in the user interface as originally proposed.

In addition to simplifying VCR programming, users who do a substantial amount of program taping also need an improved system and process for keeping track of their recorded programs. Commonly assigned Application Serial No. 07/219,971, filed July 15, 1988, in the name of Patrick Young, discloses a system and process that

provides indexing capability for taped material. A user interface for a television schedule system and process should also handle this capability on an intuitive basis.

Thus, while the art pertaining to the control of VCRs and to television schedule systems is a well-developed one, a need still remains for a television schedule system and process incorporating an improved user interface. In particular, unlike most computer menus, a grid TV guide is an array of irregular cells, where the cell size can vary from a fraction of an hour to many hours--extending well beyond the current screen. If this array is navigated by a cursor that goes from cell to cell, a single cursor command can produce violent screen changes. For example, a cursor right command may cause an abrupt jump to a cell situated several hours from the current page. Not only is this unsettling, but may take considerable effort to recover. Clearly, a gentler cursor motion is needed for the irregular cells found in a grid TV guide.

Printed grid television schedule guides often include additional information besides the program title and broadcast names. Such grids are also typically provided in combination with a more detailed printed schedule that contains a synopsis of each program, whether the program is a repeat, ratings for movies, and other information. When using a television set as a display for a schedule system, the size and resolution of the television display limit the amount of text that can be displayed with the grid. Improved techniques are required for conveying the most amount of information to the user in an easily understood manner within the limitations of the television display. When a large number of channels are available for viewing, there is also a need to order the display of information most conveniently for the user.

**SUMMARY OF THE INVENTION**

Accordingly, it is an object of this invention to provide a television schedule system and process with a user interface that is configured to compensate for the particular nature of the television schedule information.

It is a further object of the invention to provide such a user interface having a cursor operation that compensates for an irregular grid format of the television schedule information.

It is another object of the invention to provide such a user interface in which the schedule information is presented in a format that compensates for limited resolution of the television display.

It is still another object of the invention to provide such a user interface in which supplemental schedule information is presented in overlays that obscure a minimum amount of useful other information.

It is a still further object of the invention to provide such a user interface in which order of presentation of the schedule information is customizable by user preference.

The attainment of these and related objects may be achieved through use of the novel television schedule system and process user interface herein disclosed. A television schedule system including a user interface in accordance with this invention has a display, A means is connected to the display for displaying the television schedule on the display as an array of irregular cells which vary dimensionally in length, corresponding to different television program time lengths. A means is connected to the display for providing a cursor with the television schedule on the display. The cursor has a variable length corresponding to the length of a selected one of the irregular cells

in which the cursor is located. A means is connected to the means for providing the cursor for moving the cursor in the array in a series of equal length steps. At least some of the irregular cells have a length which  
5 is greater than the length of the steps.

In the process of operating a television schedule system with the user interface of this invention, the television schedule is displayed as an array of irregular cells which vary dimensionally in length, corresponding  
10 to different television program time lengths. A cursor is provided with the television schedule on the display, the cursor has a variable length corresponding to the length of a selected one of the irregular cells in which the cursor is located. The cursor is moved in the array  
15 in a series of equal length steps, with at least some of the irregular cells having a length which is greater than the length of the steps.

In another aspect of the invention, a control system for a video recording machine has a controller for  
20 starting and stopping the video recording machine, for recording video information on recording media, and for playing recorded video information on recording media. A display generator provides display image generation signals. A means supplies information to the display  
25 generator for generation of display images relating to operation of the video recording machine. The means for supplying information includes means for generating a recording media position indicator graduated as segments corresponding to programs recorded on the recording  
30 media.

In a process for controlling a video recording machine, a recording media position indicator is graduated as segments corresponding to programs recorded on the recording media. The recording media position

indicator is displayed as position of a selected one of the recording media in the video recording machine is changed.

In a further aspect of the invention, a television  
5 schedule system a display and means connected to the display for displaying the television schedule on the display. The means for displaying a schedule is configured to allow selection by a user of a first number of desired channels for display of schedule information  
10 which is less than a second number of available channels. A programmable tuner is connected to the means for displaying a schedule. The programmable tuner is configured to follow the first number of desired channels when the television schedule is shown on the display in  
15 response to a channel up or channel down command. The programmable tuner is configured to follow the second number of available channels in the absence of the television schedule on the display in response to a channel up or channel down command.

20 In a process for operating a television schedule system, a first number of desired channels is selected for display of schedule information, which is less than a second number of available channels. The schedule information is displayed on a display. The first number  
25 of desired channels is followed when the schedule information is shown on the display in response to a channel up or channel down command. The second number of available channels is followed in the absence of the television schedule on the display in response to a  
30 channel up or channel down command.

The attainment of the foregoing and related objects, advantages and features of the invention should be more readily apparent to those skilled in the art, after review of the following more detailed description of the  
35 invention, taken together with the drawings, in which:



**BRIEF DESCRIPTION OF THE DRAWINGS**

Figures 1-3 are diagrammatic representations of a television schedule grid incorporating the user interface for the system and process of this invention.

5        Figure 4 is a diagrammatic representation of a screen display used in the system and process of the invention.

10        Figures 5-7 are additional diagrammatic representations of the television schedule grid incorporating the user interface for the system and process of the invention.

Figure 8 is a flow chart for understanding the operation of the Figure 7 diagram.

15        Figures 9-10 are additional diagrammatic representations of screen displays of the user interface for the system and process of the invention.

Figure 11 is a flow chart for understanding the operation of the Figures 9-10 diagrams.

20        Figures 12-13 are diagrammatic representations of taping and tape index screen displays of the user interface for the system and process of the invention.

Figure 14-17 are diagrammatic representations of program selection by category screen displays of the user interface for the system and process of the invention.

25        Figure 18 is a flow chart for understanding operation of the Figures 14-18 diagrams.

Figure 19 is a flow chart for understanding operation of the Figure 20 diagram.

30        Figure 20 is a diagrammatic representation of a channel customization screen display of the user interface for the system and process of the invention.

Figure 21 is a diagrammatic plan view of a control panel for the system of the invention.

35        Figure 22 is a block diagram of a television schedule system in accordance with the invention.

**DETAILED DESCRIPTION OF THE INVENTION**

Turning now to the drawings, more particularly to Figures 1-7, there are shown a series of menu screens 10, 12, 14, 16, 18, 20 and 22 used in operation of the system and carrying out the process of the invention. Screens 10, 12, 14, 18 and 20 each consists of an array 24 of irregular cells 26, which vary in length, corresponding to different television program lengths of one half hour to one-and-one half hours or more. The array is arranged as three columns 28 of one-half hour in duration, and twelve rows 30 of program listings. Some of the program listings overlap two or more of the columns 28 because of their length. Because of the widely varying length of the cells 26, if a conventional cursor used to select a cell location were to simply step from one cell to another, the result would be abrupt changes in the screens 10, 12, 14, 18 and 20 as the cursor moved from a cell 26 of several hours length to an adjacent cell in the same row. Such abrupt changes disorient a user of the system.

An effective way of taming the motion is to assume that behind every array 24 is an underlying array of regular cells. By restricting cursor movements to the regular cells, abrupt screen changes will be avoided. However, there is now a potential ambiguity between the underlying cell which governs cursor movement and a visible cell 26 which holds the program title.

Viz.: if the cursor moves in half hour steps, and the cell length is, say four hours, should the cursor be 1/2 hour long or four hours long? If the cursor only spans the interval of the underlying cell (1/2 hour), the cursor appears to be highlighting a segment of the cell, which is misleading. On the other hand, if the cursor spans the entire four hours of the TV listing, the cursor underlying position will be obscure. In this

case, cursor right/left commands will appear inoperative while traversing a long cell. The absence of feedback following a cursor command is befuddling to users. Therefore, an innovative cursor 32 (Figure 1) for the irregular array 24 is required which satisfies several conflicting requirements.

With the cursor 32, the entire cell 26 is 3-D highlighted, using a conventional offset shadow 34. The offset shadow 34 is a black bar that underlines the entire cell and wraps around the right edge of the cell. To tag the underlying position--which defines where the cursor 32 is and thus, where it will move next--portions 36 of the black bar outside the current underlying position are segmented, while the current position is painted solid.

For an half hour cell 26, the offset shadow's underline bar will always be solid black. Figures 2 and 3 show the cursor 32 as it appears for a half-hour program. For programs that go beyond 1/2 hour, only the current 1/2 hour position will be solid black. All remaining positions will be stripped. If the cursor is moved left or right, the solid section will move accordingly, providing complete visual feedback. Thus, this modified 3D offset shadow cursor 32 satisfies the demands stated above: it spans the entire cell, yet clearly highlights the current underlying position. Movement of the cursor 32 will always be visible even for cells 26 that are much longer than the underlying cell.

A grid continuity icon 38 is shown in Figure 1. Printed grid television schedule guides often include parenthetical comments, (such as "cont'd") to indicate program continuity. In an electronic guide displayed on a TV screen, limited text space precludes parenthetical comments. To conserve space, an icon 38

will be used to indicate cell 26 continuity. At the border of a cell 26 that is continued to the next screen, an arrow icon 38 pointing to the right will be overlaid. The arrow direction always points to right, which is the direction of program elapse.

Figures 2 and 3 show recording status representations. When a program has been selected for recording, its listing cell 26 will be outlined or highlighted in red, as indicated at 40. If guard time has been added or deleted, the cell will be stretched or shrunk to reflect the change. Cell 26 continuity will be treated the same as above. There are four other record status representations:

If the cell is actively being recorded, the outline 40 will blink off and on.

A recorded cell will be displayed with a solid red background 42 (Note: Not shown in drawing).

A mis-recorded cell will be indicated by red hash-marks 44 over the title. A mis-recording can be the result of insufficient tape, VCR loss of power, stopped before completion, etc.

A program linking icon 46 is shown in Figure 5. After each schedule update, the schedule system examines the new listings for the occurrence of any titles that match a title in Linked Titles (Figure 23). If a title matches, it will automatically be tagged for recording. When a linked program is displayed in the guide, it will have two identifiers: a red outline 40 indicating that the title has been selected for recording, and a link icon 46 appended to the title to indicate that this title was link-selected. After a linked program has been recorded, it will be treated like any recorded program with the title shaded in red. To differentiate this recording from others, the link icon will remain appended to the title.

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Further details on the linking feature are given in screen 19 of Figure 23. 1) A linked program 47 may be suspended by the user (perhaps to avoid conflict with a pending recording), by de-selecting the link title in the Link List screen, under the Record Memo command. A suspended link program will still be identified by a link icon, but the red-outline will be suppressed since the program will not be recorded. 2) A smart link process is used to tame the matching of titles when there is a likelihood of excessive candidates for recording. The Lucy show, for example, is often syndicated on several channels. Untamed linking of Lucy may result in a plethora of recordings. For such series, the link list will include the channel and time as well as the link title. For the avid Lucy-phile, the user can locate each series individually for linking. If there is more than one link title of the same name, the series will be numbered, in the order of acquisition. Thus, the second Lucy will be identified as Lucy (Two), at 47.

Figures 1-3 show the columns 28 headed by half-hour header status indicators. The 1/2 hour header strip across the top of the grid TV guide has two auxiliary functions: 1) as an indicator 48 of pending or in-progress recording scheduled at that time, and 2) as a time-bar 50 to delineate the past from the future. The past is darkened, while the future is lightly shaded. If there is an in-progress recording, the 1/2 hour header will be red-outlined at 48 in the same manner as a pending recording title cell 26.

Figure 6 shows a television schedule grid screen 20 with a program note overlay 52. With limited text capacity on TV displays, it is preferable to display as many lines of TV listings as feasible. To handle program notes, which are text intensive, on-demand overlays 52

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are used. Program note overlays 52 may include any or all of the following information:

- o A program genre
- o Program description
- 5 o Stars and personalities
- o Year of release
- o Episodic subtitles
- o Run-time of program
- o Elapse time of the program
- 10 o Critique (Star Ratings)
- o Rating (PG, G, etc.)
- o Call letter, channel markers
- o Closed caption, stereo.

Program notes for a selected program are overlaid  
15 over the grid guide upon request. The program note can be toggled off/on using a SELECT command. The program note 52 overlays and hides 3 or 4 listings of a guide. To minimize concealment of the guide, an auto-roving note is used. The program note will overlay either the top  
20 half or bottom half of the screen, as necessary to avoid masking the title of the selected listing. If the cursor 32 is in the upper half of the screen, the note will appear in the bottom half, and vice versa. If the cursor 32 is moved to the lower half of the screen, the note  
25 will automatically position itself in the upper half of the screen.

Figures 1-3 and 5-6 show a channel column 54 in the television schedule grid 24. Favorite stations and cable channels may be listed together to create a personalized  
30 grid guide. The channel column 54, unlike most printed TV guides, has a mix of over-the-air station names and cable services names.

The grid 24 guide lists channels by favorite combinations of station number and cable names, and not  
35 in the usual numerical order. When viewing the grid 24 guide, a Tuner Up/Down channel command will be mapped according to the channels and order listed on the screen. When not viewing the guide, the tuner sequence will

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revert back to the usual numerical order. When the last channel on a page is reached, the next Tuner command will change the channel to the channel listed at the beginning of the following page.

5        When a channel to which the tuner is tuned is displayed on the grid 24, it is highlighted, as shown at 56. A grid 24 page may be changed by either a page command or by entering a channel Up/Dn command as described above. If a page is turned using the page  
10        command, the current channel is now located in the previous page, and will not be seen in the new page. Therefore, the new page must suppress the highlighting of a channel, since that indicates the current channel. Note that information about the current channel will  
15        still be presented in the channel information boxes 58 at the bottom of the screen.

When is the highlighting re-enabled? Once into the new page, the first channel up/down command will cause the tuner to automatically change to the channel listed  
20        in the last or first row 30 respectively of the new page. Since the tuner channel is now located on the new page, the current channel will be highlighted again.

If the channel highlighting is not suppressed after a page is selected, by definition, the tuner must be  
25        changed to track the highlighted channel. This is undesirable since casual paging should not cause the channel to change.

When a guide is first opened, as shown in Figure 2, both the cursor 32 and the current channel 56 are  
30        situated on the same row 30 of the grid 24. When the channel 56 is changed, it is desirable to drag the cursor 32 along with the channel in unison. In doing so, the cursor 32 will be ready for a Select command (to retrieve the program note) or for a Record It command. Cursor  
35        dragging by the channel command takes place whenever the

channel 56 and cursor 32 are united on the same row. If they are not united, the cursor 32 is disengaged from the channel command. Note that dragging is not reciprocal; moving the cursor 32 does not affect channel selection.

Figure 7 shows a screen 22, showing a program list 58 for a single channel, generated by toggling a user What's On TV command, which switches between the grid 24 and the list 58. The list 58 consists of rows 60 of sequential program listings on the channel and a channel information field 62. Program notes are overlaid on the list 58 in the same manner as shown in Figure 6 for the grid 24.

Each What's On TV command alternates between the grid guide 24 and the What's Next on Channel row guide 58. While viewing the grid guide 24, the next What's On TV command will replace the grid guide 24 with a single-channel row guide 58. Figure 8 is the flow diagram for the What's On TV command.

The page relationship between the two guides 24 and 58 are tightly coupled. The single channel guide will open to the channel and schedule time that was selected by the cursor 32 on the grid 24. While viewing the single channel guide 58, the Up/Down channel command may be used to change the channel to be listed. When exiting the single channel guide 58 and returning to the grid guide 24, the grid cursor 32 will be pointed to the channel and schedule time last selected on the single channel guide 58.

Figures 9 and 10 show channel grazing overlays 64 and 66 that provide information on current programs when switching channels while watching television. In the overlay 64, when scanning channels, the title of each program is overlaid at 68, along with the name of the TV service (HBO, ABC etc.), the cable channel number,



and the current date, day of week, and time in the channel information field 62. The overlay 66 is the same as the overlay 64 except that this overlay includes a program note 70, which is similar to the program note 52 in Figure 6, but contains information pertinent to a program currently being broadcast on the selected channel. To access program notes, press the Select key. In addition to the program note 70, elapsed time is indicated by a percentage calibrated time bar 72. The bar is bracketed by S for start, and F for finish. By default, titles will appear automatically when channels are scanned. Grazing Titles may be de-activated using the CANCEL key. To restore auto-titles, press Select while viewing TV. The flow diagram governing titles/program notes, while viewing TV, is shown in Figure 11.

An express recording screen 74 is shown in Figure 12. The express recording screen includes the following information:

Title of Program  
Length of Program  
Tape Time Remaining  
Recording Speed.

Figure 13 shows a tape index screen 76. Locating a recorded segment is often an arduous task when several programs have been recorded on the tape. Without a table of contents, the VCR users muddle through stretches of recording trying to find what's recorded on the tape, where the beginning of the desired program is, and where the tape is now. Some premium VCRs provide tape indexing that automatically finds the start of each recording. However, while the viewer can find the start of a recording, the indexing VCRs do not record titles. The net result is about as useful as a having a table of contents without chapter titles. Considerable searching

is still required to find what is recorded at each index.

The tape index screen 76 provides a virtual tape directory, giving the equivalent function of a table of contents for a tape recording. There is a list 78 of  
5 titles of recorded programs, a pointer 80 to the start of the program, and a current position indicator cursor 82 showing the "chapter" location on the tape. The virtual directory is automatically compiled, revised and stored in off-tape memory as the user records over the  
10 tape.

The What's on Tape command will display a list of titles of programs recorded on the tape. The title of the selected program (the segment of tape that is positioned over tape head) is highlighted by the cursor  
15 82. The tape position pointer 80 dynamically tracks the current tape position. All searching is done simply by title, bypassing the need for index numbers. The tape directory is equivalent to a table of contents showing titles, but not page number. It automatically opens to  
20 the starting page by simply pointing to the title of the program. In addition to the tape directory 78 of recorded programs, the screen 76 includes a program duration field 84, a recorded speed of each title field 86, a remaining time left on tape field 88, a remaining  
25 time left on program field 90 and a next scheduled recording time field 92.

The virtual tape directory is generated as follows. It is difficult to implement a competent self-contained tape directory for a non-random access storage such as  
30 a video tape. No matter where the directory is stored on the tape, the latent access time to locate the directory and return to current position (for a standard six hour tape) is excruciating slow, in the order of 6 to 10 minutes.

If redundant directories are recorded uniformly across the tape to minimize latency time, the problem of sluggishness is merely shifted from playback to updating the multiple directories. After each video  
5 program is recorded, the entire tape must be scanned to update each directory. Even if this update process is automated, there is a question of excessive wear on tapes and the VCR itself. Viz: each recording, no matter how short, results in high-speed scanning of the entire tape  
10 in order to revise all directories.

Even more troubling is the question of when to perform the update, since there is no "safe" period for the VCR to take control. For example, the user may have stopped the tape momentarily, perhaps to skip  
15 commercials, only to find that the VCR has commandeered control and place the tape in a high speed update mode. The safest update is one that is user-initiated. Unfortunately, few VCR users will follow a regimented procedure of updating after each recording session.  
20 Clearly, an on-tape directory based on existing technology is not satisfactory.

The following innovative solution, the "virtual tape directory", stores directory information in off-tape memory and does not require an on-tape directory or any  
25 augmentation of the video cassette. Since the directory is held in external memory instead of the tape, it is best suited for tapes that have recently been played and recorded, the "working tapes".

When a program is recorded, the title of the program  
30 is written to the data (control track) channel of the tape and, at the same time stored in a non-volatile (NV) memory. Other information about the recorded program, such as length of program, theme category, date recorded, and tape identifier code may be written to the data

channel, as well as stored in the NV memory. The NV memory is adequate to support a number of working tapes.

When a tape is first loaded, the tape data channel will be scanned for a few seconds to identify the recorded program under the tape head. This data will be matched against the directories stored in NV memory. If there is a match, the directory of the working tape will be displayed immediately when the What's On Tape key is pressed. The "virtual" tape directory appears to have been read from the tape, but is actually obtained from NV memory.

If there is no match, a new directory for the tape will be created. During playback and recording of this tape, a virtual directory will be generated for that tape. Directories of inactive tapes will be automatically purged from memory as new working tapes are introduced.

It is relatively easy to estimate remaining time of a scheduled televised program with the assist of a clock and a TV schedule. In contrast, there are few clues as to current location during playback of a recorded program, particularly when there are several recorded segments on a tape. Tape index counters or running-time clocks require diligent bookkeeping before the start of a recorded segment. Few consumers will tinker with 5 or 6 digit numbers when a "ballpark" indicator is adequate, such as, "is the program about over?", or "about when does the next segment starts?".

Clearly, there is need to provide a location indicator without the burden of bookkeeping.

To provide an at-a-glance indicator of relative tape location, an on-screen tape position gauge 94 has been devised. The tape position gauge 94 consists of a vertical bar 96 with the arrow pointer 80 located on the left edge of the screen 76. The arrow 80 dynamically

tracks the current tape position as the tape is advanced or rewound.

The gauge 94 is graduated, not in linear units, but in units of recorded segments 98 with each segment labelled with its program title. Thus, a 10 minute program or a 6 hour program is represented as one vertical unit corresponding to the width of a segment 98. However, the gauge 94 is linear within each segment 98. If the arrow is pointing at the upper 25% of the program segment 98, it indicates that the tape head is positioned over the first 25% of the program. If a conventional linear gauge were displayed, a far more complicated gauge would be required, that would likely confuse rather than clarify.

Thus, this tape gauge 94 provides a quick capsule indication of the where the tape head is currently positioned, relative to the current program, and relative to other programs or the tape, and the title of other programs.

The tape index screen 76 includes a tape motion indicator field 100. When the tape is undergoing high speed repositioning, the What's On This Tape (WOT) screen 76 will be displayed. During high speed search of a long program, the tape gauge 94 will appear to be dormant, since the gauge is relatively coarse for programs of long duration. To supplement the tape gauge 94, the tape indicator 100 is included. During high speed positioning, one of these messages will be displayed in the space above twin-hub tape icon 102: GO PLAY, GO RECORD, FORWARDING, REVERSING, PAUSE, and STOP.

GO PLAY is displayed while the tape is repositioning to the selected title. When the title is reached, the WOT screen 76 will be displaced by the playback video. GO RECORD is displayed while the tape is positioning to

the selected program segment 98, where the new recording will be written.

Figures 14-17 show Theme function screens 104. The Theme function allows the viewer to quickly sort the downloaded schedule and display a subset schedule based on a subject of interest. The user has the freedom to select listings sorted first by major themes, second by topic(s) within a theme, and/or by topic qualifiers. All guides sorted by theme, topic and qualifier will be displayed in a row-tabulated format and begins by listing programs nearest to the current half-hour. The theme function screens 104 have the following attributes: Rotating Themes. There are four theme categories, with each theme title enclosed in horizontally-arranged selection boxes 106. From left to right, the themes are: [Movies] [Sports] [Specials] [TV Fare]

Figure 18 is a flow diagram defining the Theme command. Topic Selection. There are up to 16 topics 108 for each theme arranged in an 8 row by two column field 110. Any number of topics may be selected under a selected theme. Topics is a logical OR function, meaning that each listing that meets the definition of the topic will be displayed. For example under the theme of Movies, if the topic titles Comedy and Satire are selected, a subset schedule of both comedy movies and satire movies will be displayed.

Default All Selection. When the Theme screen 104 is first opened, the first slot (upper left most topic 108) will be highlighted. This is the ALL function, which is the sum of all topics 108 for the selected theme. The ALL function was created to minimize key stroking. Without an all topic category, the user must enable all 16 topics 108 individually. Conversely, if the user wishes to go from an all topics to an individual topic,

the user must cursor to and deselect each of the other 15 topics.

Qualifiers. Each theme includes a group of search attributes or qualifiers 112. The qualifiers for each 5 theme 106 are shown in the respective one of Figures 14-17 for each theme 106. Any number of qualifiers can be enabled at one time. These qualifiers perform a logical OR functions; they will select for display all listings (sorted first by theme and topic) that satisfy the 10 qualifiers.

The qualifiers 112 are positioned for easy selection. The selection of qualifiers is made using the usual cursor commands. When a theme 106 is initially opened, by default, the cursor is located near the top of the 15 screen. To minimize cursor commands, the qualifiers are also located near the top of the screen. In contrast, placing the qualifiers at the bottom of the screen would require a round trip of up to 16 key strokes.

The complete theme sorting strategy is defined as 20 follows:

Listings = (Topic A + Topic B + etc.)\*(Qualifier A + Qualifier b + etc.)

This may be read as listing all Topic A that also meets Qualifier A or Qualifier B, plus all Topic B that 25 also meets Qualifier A or Qualifier B, etc.

Qualifiers, topics and themes are rooted in relational database operations and allow logical sorting of the schedule. To support these higher order of sorting, auxiliary data must be delivered to the VCR. 30 In contrast, simple sorting operations, such as sorting by time and by channel are inherent in the fundamental information of a TV guide, and do not require auxiliary search data.

The keystroke sequence for using the themes screens 35 104 are as follows. While watching TV, the first Theme

key command will summon the opening theme screen with the left most theme, Movies, highlighted. Further theme commands will rotate the theme selection from left to right. Each theme screen will be initialized to the ALL  
5 (topics) selection. If no topic selection is made, an all topics guide for the selected theme will be displayed upon depressing the Select/Goto command.

To additionally sort the theme by a single topic, position the cursor key to the desired topic and depress  
10 the Select/Goto key. Use the cursor to return to a topic.

To sort by more than one topic, position the cursor over each desired topic and depress the Select key. When finished, press Select/Goto to display a multiple-topic  
15 guide.

To sort by one or more attributes, position the cursor over each desired attribute and press the Select key. When finished, move the cursor to a topic and press Select/Goto to retrieve the theme/attribute-sorted TV  
20 guide.

Other than express recording, all recording activities are controlled with the Record Memo screen 16 of Figure 4. The Record Memo screen 16 is accessed with a Record Memo key. When the Record Menu key is  
25 depressed, the following titles enclosed in horizontally-arranged selection boxes 114 will appear at the top of the opening screen. From left to right:

[Pending	[Recorded	[Linked	[On-Grid
Recordings]	Programs]	Titles]	Prog.]

30 Each Record Memo key command will highlight a new selection, rotating from left to right, and wrapping around to Pending Recordings after the right most position. Figure 19 is a flow diagram defining the Record Memo command.



Figure 20 shows a Channel Customization screen 116. The screen 116 allows the user to customize channels to match viewing interest, providing a compact listing as well as eliminating undesired channels during up down  
5 scanning. During schedule update, a list of all cable channels available at the subscriber's cable system (or broadcast stations for over-the-air subscribers) is also delivered to the VCR. This unabridged set of channels may be customized using screen 116.

10 The channel customization screen 116 has two fields, a 3 column field 118 listing up to 36 unabridged channels and a single column field 120 listing 12 favorite MY channels. The latter is a replica of the channel descriptor column 122 (Figure 1) of the opening grid  
15 guide. Additional pages are available (using the page key to swap between the pages) to accommodate systems with more than 36 channels. Each cell 124 in the 3 column field 118 contains the following information: Channel number and program service name (such as HBO or  
20 station KTVU, 2). The cell 124 is color-coded to indicate the following states:  
ON, default state before any customization, with the cell 124 in light green background.  
MY, favorite channels listed in the single column field  
25 120, also shown in the three column field 118 with a blue background.  
OFF, a channel deleted from all guides, as well as during Channel Up/Dn scanning (still accessible using the ten key channel keypad). OFF cells have a gray  
30 background.

When first installed, the system assigns the first 12 (listed in numerical order) channels as MY favorites. The channel status may be changed by selecting a channel and picking a state, MY, ON, or OFF using the SELECT key.  
35 Since only 12 favorites are allowed, the user must

first remove a favorite channel by changing the status of an existing favorite channel to OFF or ON. When that is done, the first column will automatically open up a space for the next MY selection. When a new MY is  
5 selected, the MY column 120 will automatically insert the new selection in the prescribed order. The order of listing in the MY favorite channel column 120 is as follows:

All favorite broadcast stations will be listed first  
10 in numerical order. Next, all cable services will be listed in alphabetical order.

A new cable service, which displaces a previous service, will be inserted under the previous status. Example: If the channel was MY, the new service will be  
15 MY. However, a new cable service that appears on a new channel will be initialized ON.

Figure 21 shows a front panel 130 for a remote controller of the schedule system. The top half of the front panel 130 corresponds to a conventional remote  
20 controller for a television set and a VCR. Included are a dual function ten key keypad 132, with the alternate functions of each key and its digit shown, a TV/VCR toggle key 134, volume and channel up/down keys 136, and VCR control keys 138. The lower half of the front panel  
25 130 contains control keys that are specific to the schedule system. Included are a What's On Tape key 140, a What's On TV key 142, a Theme key 144, a Record Memo key 146, a Record It key 148, a Link It key 150, a Help/Menu key 152, a Select/Goto key 154, Left, Right,  
30 Up, Down and Page Cursor keys 156, a Return TV/VCR key 158 and a Cancel/Undo key 160. The use of these keys has either been explained above or is apparent from their labels.

Figures 22A and 22B are block diagrams of television  
35 schedule systems/tape controllers 180 and 182 in which

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the user interface is used. The schedule system/controller 180 is applicable to existing television equipment, where the schedule system is separate from the basic television equipment.

5 Programmable tuner 202 is shown as part of a cable decoder. The schedule system/controller 182 is shown as integrated into a VCR 211. In this version, a cable decoder is not required, and tuner 207 is part of the VCR 211. It should be clear from these two systems 180

10 and 182 that the schedule/tape controller may be integrated into other television equipment, such as a cable decoder or a TV/Monitor receiver. It is also practical to implement the entire schedule/tape controller in a remote controller by adding a text

15 display, such as an LCD screen, on remote controller 212.

In the system 180, programmable tuner 202, which may be part of a cable decoder unit, receives a TV signal from antenna 200 and/or from cable input 205. Tuner output 216 goes to a vertical blanking interval (VBI)

20 decoder 222, which may be a closed caption decoder or a high speed teletext decoder. Listing information and other support information, such as cable channel assignment data, will be transmitted over the VBI by one or more local stations or cable channels several times

25 a day or continuously.

When update is required, programmable tuner 202 will be tuned automatically to the station or cable channel carrying the data. After the VBI signal is processed by CPU 228, the listing data is stored in schedule memory

30 232, while the cable channel assignment data is stored in cable-specific RAM memory 238. This data is used to convert generic TV source names, such as HBO, to channel assignments for the specific cable system.

Other information transmitted to the schedule/tape

35 controller 180 and stored in the system RAM memory 240

includes clock update data to set system clock 230 automatically, schedule update time, which may vary from once a day to a continuously transmitted format, new theme categories, and last minute schedule change data.

5       For a What's on TV request, the listing stored in schedule memory 232 is retrieved, processed by CPU 228, and outputted to video display generator 224. Video switcher 226 is enabled by CPU output 246 to select the video display generator 224 output whenever schedule data  
10 is to be presented to the TV/monitor 210.

When a request to time-shift record a program is made, the title of the program and its record parameters (channel, start time and length) is copied from the schedule memory 232 to the Record Memo RAM memory 236.  
15 When the system clock 230 matches the schedule time, the CPU 228 will issue a channel command to the programmable tuner of the cable decoder 202, and a power on and record command to VCR 206 by means of an infrared remote driver 214 directed at infrared input ports of these two  
20 devices. In the VCR integrated version 182, the command to the tuner 207 is made on a wired bus 264.

In addition to programming by selecting a title from the on-screen schedule, it is also possible to program the VCR 206 or 211 and the cable decoder 202 or 207 with  
25 remote controller 212. In this mode, programming information is entered into the remote controller 212, and at the required time, the remote controller 212 will issue programming commands to the proper TV device. While there are many universal remote controllers that  
30 offer programming capability, none allow the user to enter generic names, such as station and cable channel names, and have the CPU convert the names to specific channels for tuning the VCR or the cable decoder. This is implemented by incorporating CPU 228 and the cable-  
35 specific RAM 238 in the remote controller 212.

Remote controller 212 and infrared remote driver 214 are capable of emulating the infrared command instructions required by the cable decoder 202 and VCR 206. The command emulation codes for the remote driver 214 are stored in cable decoder IFR code RAM/ROM memory 239. Commands for popular cable decoders and VCRs are pre-programmed in ROM. Alternatively, the infrared commands of the original remote controller may be learned by aiming the controllers at the IFR input receiver 264 and storing the command codes in RAM memory 239 after processing by CPU 228. This process is well known in the art of universal remote controllers and need not be detailed here.

As shown in Figure 22A, the VCR 206 and cable decoder 202 may be manually controlled by remote controller 212, or it may be automatically controlled by infrared remote driver 214.

During recording, the tape index location of the VCR 206 will be transmitted over control/data bus 270 to the CPU 228. This start address information is stored in tape directory RAM memory 234, together with the program title. The bus 270 also carries VCR control commands for recording, playback, tuner selection, and other functions, including power on/off.

Once a program is recorded, its title and other program information is stored in a section of the Record Memo RAM memory 236. To play back a recorded program, the What's on Tape request will cause a directory of recorded programs on the tape to be displayed. When a program is selected for playback from this directory, the tape will fast forward or reverse to the tape index location specified in the Tape Directory RAM memory 234.

In the system 182, schedule/tape controller 220 is embedded in the VCR 211. The VCR tape mechanism 252 contains all the record and playback electronics of the

video recorder, less the programmable tuner 207. Data recorded on the control track of a tape is coupled to the CPU 228 over input bus 258 and output bus 256. The art of recording data on the control track is well known, for example, in recent VCRs with indexing capability. CPU 228 commands to the VCR 211 are carried over bus 254. When schedule information is to be displayed, video switcher control input 246 selects the display generator on line 218. At other times, video switcher 226 selects the output of the VCR mechanism 252 on line 250.

Schedule information may be downloaded from the VBI. Alternatively or supplementally, it may be downloaded from a telecommunication line 270 to modem 268 and to CPU 228 via line 266. Other means of delivering schedule information can be employed, including the use of a subcarrier channel on the cable service.

It should now be readily apparent to those skilled in the art that a system and method incorporating a novel user interface capable of achieving the stated objects of the invention has been provided. The user interface that is configured to compensate for the particular nature of the television schedule information. The user interface has a cursor operation that compensates for an irregular grid format of the television schedule information. The user interface presents the schedule information in a format that compensates for limited resolution of the television display. The user interface presents supplemental schedule information in overlays that obscure a minimum amount of useful other information. Order of presentation of the schedule information in the interface is customizable by user preference.

It should further be apparent to those skilled in the art that various changes in form and details of the invention as shown and described may be made. It is

intended that such changes be included within the spirit and scope of the claims appended hereto.

**WHAT IS CLAIMED IS:**

1. A television schedule system, which comprises:  
a display,  
means connected to said display for displaying the  
5 television schedule on the display as an array of  
irregular cells which vary dimensionally in length,  
corresponding to different television program time  
lengths,  
means connected to said display for providing a  
10 cursor with the television schedule on the display, said  
cursor having a variable length corresponding to the  
length of a selected one of the irregular cells in which  
the cursor is located,  
means connected to said means for providing the  
15 cursor for moving the cursor in the array in a series  
of equal length steps, with at least some of the  
irregular cells having a length which is greater than  
the length of the steps.
2. The television schedule system of Claim 1 in  
20 which said means for providing the cursor is configured  
to provide the cursor with a first portion corresponding  
to one of the steps at which the cursor is positioned  
having a first appearance and a second portion outside  
the one of the steps at which the cursor is positioned  
25 having a second appearance different than the first  
appearance.
3. The television schedule system of Claim 2 in  
which the first portion of the cursor has a solid  
appearance and the second portion of the cursor is  
30 segmented.
4. The television schedule system of Claim 1 in  
which said means for displaying the schedule is



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configured to show a portion of the array corresponding to a given period of time, said means for displaying the schedule being further configured to display a continuity icon with programs contained only in part within the  
5 given period of time.

5. The television schedule system of Claim 1 in which said means for displaying the schedule is further configured to display the irregular cells with a different appearance to indicate recording status.

10 6. The television schedule system of Claim 5 in which said means for displaying the schedule is configured to display the irregular cells with different appearances to show that a program has been selected for recording, is presently being recorded, has been  
15 recorded, and was mis-recorded.

7. The television schedule system of Claim 1 in which said means for displaying the schedule is further configured to display a linking icon with programs that are to be recorded in combination with other programs.

20 8. The television schedule system of Claim 1 in which said means for displaying the schedule is further configured to display a time status indicator delineating past time from future time.

25 9. The television schedule system of Claim 1 in which said means for displaying a schedule is further configured to display a program note overlay for a selected program on a portion of the array.

10. The television schedule system of Claim 9 in which said means for displaying a schedule is further

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configured to display the program note overlay in different locations to avoid masking a title of the selected program.

11. The television schedule system of Claim 1 in  
5 which said means for displaying a schedule is further configured to allow selection by a user of a first number of desired channels for display of schedule information which is less than a second number of available channels.

12. The television schedule system of Claim 1  
10 additionally comprising a television tuner connected to said means for displaying a schedule and in which said means for displaying a schedule is further configured to display a channel to which said television tuner is tuned with a different appearance than other channels  
15 in the schedule.

13. The television schedule system of Claim 12 in which said means for displaying a schedule is further configured so that the cursor follows a change in a channel to which said television tuner is tuned.

20 14. The television schedule system of Claim 1 in which said means for displaying a schedule is further configured to display alternatively a schedule for a plurality of channels covering a first time period or a schedule for a single channel covering a second time  
25 period.

15. The television schedule system of Claim 1 additionally comprising a television set connected to said means for displaying a schedule and in which said means for displaying a schedule is further configured  
30 to display an overlay containing information on a

television program being shown on said television set when a channel being shown on the television set is changed.

16. The television schedule system of Claim 15 in which the information on the television program includes program title, name of television service, channel number, date and time.

17. The television schedule system of Claim 16 in which said means for displaying a schedule is further configured to provide an alternate overlay including a program note for the television program being shown on said television set.

18. The television schedule system of Claim 1 additionally comprising a recording device connected to said means for displaying a schedule and in which said means for displaying a schedule is further configured to display information about recording in response to a user command to record a program.

19. The television schedule system of Claim 1 additionally comprising a recording device connected to said means for displaying a schedule and in which said means for displaying a schedule is further configured to display an index of recorded programs.

20. The television schedule system of Claim 19 in which the index of recorded programs includes an identification by title.

21. The television schedule system of Claim 19 in which the index of recorded programs includes a pointer

showing current location on a recording medium in said recording device.

22. The television schedule system of Claim 21 in which the pointer is graduated in segments corresponding to each recorded program on the recording medium, and linearly with respect to position in each segment.

23. The television schedule system of Claim 19 additionally comprising a memory for the index connected to said means for displaying a schedule, said memory having a capacity to store an index for a plurality of recording media for said recording device.

24. The television schedule system of Claim 23 in which the recording media include a data channel and said recording device is configured to include a title of a program recorded on the recording media in the data channel, said means for displaying a schedule is further configured to compare a title in the data channel with the index in said memory and to display an index for the recording medium in said recording device based on a match of the title on the recording medium with the index in the memory.

25. The television schedule system of Claim 24 in which said means for displaying a schedule is further configured to generate an index during playback and recording with the recording medium and to store the index in said memory in the absence of a match between a title on the recording medium with the index in the memory.

26. A process for operating a television schedule system, which comprises:

displaying the television schedule as an array of irregular cells which vary dimensionally in length, corresponding to different television program time lengths,

5 providing a cursor with the television schedule on the display, the cursor having a variable length corresponding to the length of a selected one of the irregular cells in which the cursor is located,

10 moving the cursor in the array in a series of equal length steps, with at least some of the irregular cells having a length which is greater than the length of the steps.

27. The process of Claim 26 additionally comprising providing the cursor with a first portion corresponding  
15 to one of the steps at which the cursor is positioned having a first appearance and a second portion outside the one of the steps at which the cursor is positioned having a second appearance different than the first appearance.

20 28. The process of Claim 27 in which the first portion of the cursor has a solid appearance and the second portion of the cursor is segmented.

29. The process of Claim 26 in which the schedule is shown as a portion of the array corresponding to a  
25 given period of time, the process additionally comprising displaying a continuity icon with programs contained only in part within the given period of time.

30 30. The process of Claim 26 in which the irregular cells are displayed with a different appearance to indicate recording status.

31. The process of Claim 30 in which the irregular cells are displayed with different appearances to show that a program has been selected for recording, is presently being recorded, has been recorded, and was mis-  
5 recorded.

32. The process of Claim 26 additionally comprising displaying a linking icon with programs that are to be recorded in combination with other programs.

33. The process of Claim 26 additionally comprising  
10 displaying a time status indicator delineating past time from future time.

34. The process of Claim 26 additionally comprising displaying a program note overlay for a selected program on a portion of the array.

15 35. The process of Claim 34 in which the program note overlay is displayed in different locations to avoid masking a title of the selected program.

36. The process of Claim 26 additionally comprising displaying schedule information for a first number of  
20 desired channels which is less than a second number of available channels in response to user selection of the desired channels.

37. The process of Claim 26 additionally comprising tuning a television tuner to a channel and displaying  
25 the channel to which said television tuner is tuned with a different appearance than other channels in the schedule.

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38. The process of Claim 37 in which the cursor follows a change in a channel to which the television tuner is tuned.

39. The process of Claim 26 in which the television  
5 schedule is alternatively displayed as a schedule for a plurality of channels covering a first time period or a schedule for a single channel covering a second time period.

40. The process of Claim 26 additionally comprising  
10 displaying an overlay containing information about a television program being shown on a television set connected to the television schedule system when a channel being shown on the television set is changed.

41. The process of Claim 40 in which the  
15 information on the television program includes program title, name of television service, channel number, date and time.

42. The process of Claim 41 additionally comprising  
20 providing an alternate overlay including a program note for the television program being shown on said television set.

43. The process of Claim 26 additionally comprising displaying information about recording in response to a user command to record a program.

25 44. The process of Claim 26 additionally comprising connecting a recording device to the schedule system and displaying an index of recorded programs.

45. The process of Claim 44 in which the index of recorded programs includes an identification by title.

46. The process of Claim 44 in which the index of recorded programs includes a pointer showing current  
5 location on a recording medium in the recording device.

47. The process of Claim 46 in which the pointer is graduated in segments corresponding to each recorded program on the recording medium, and linearly with respect to position in each segment.

10 48. The process of Claim 44 additionally comprising storing an index for a plurality of recording media for the recording device in a memory.

49. The process of Claim 48 in which the recording media include a data channel and a title of a program  
15 recorded on the recording media is included in the data channel, the process additionally comprising comparing a title in the data channel with the index in the memory and displaying an index for a recording medium in the recording device based on a match of the title on the  
20 recording medium with the index in the memory.

50. The process of Claim 49 in which an index is generated during playback and recording with the recording medium and stored in the memory in the absence of a match between a title on the recording medium with  
25 the index in the memory.

51. A control system for a video recording machine, which comprises a controller for starting and stopping the video recording machine, for recording video information on recording media, and for playing recorded



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video information on recording media, a display generator for providing display image generation signals, means for supplying information to said display generator for generation of display images relating to operation of  
5 the video recording machine, said means for supplying information including means for generating a recording media position indicator graduated as segments corresponding to programs recorded on the recording media.

10        52. The control system for a video recording machine of Claim 51 in which said recording media position indicator is graduated according to position of the recording media within a program segment.

15        53. The control system for a video recording machine of Claim 51 in which said control system includes a memory and a means for storing indexes of video material recorded on the recording media in said memory.

20        54. The control system for a video recording machine of Claim 53 in which the recording media include a data channel and said control system has a means for including a title of a program recorded on the recording media in the video recording machine and a time of recording the program in the data channel, said control system including a means for comparing the title of the  
25 program and the time of recording with indexes in said memory and displaying an index for a selected one of the recording media based on a match between the program title and recording time on the selected one of the recording media with the indexes in said memory.

30        55. The control system for a video recording machine of Claim 54 in which said system includes a means

for generating an index during playback and recording with the selected one of the recording media and to store the generated index in said memory in the absence of a match between a title and recording time on the selected  
5 one of the recording media with the indexes in said memory.

56. The control system for a video recording machine of Claim 51 in which the video recording machine is a video cassette recorder and the recording media are  
10 video tape.

57. A system comprising the control system for a video recording machine of Claim 51 connected to a video recording machine.

58. A process for controlling a video recording  
15 machine, which comprises generating a recording media position indicator graduated as segments corresponding to programs recorded on the recording media and displaying the recording media position indicator as position of a selected one of the recording media in the  
20 video recording machine is changed.

59. The process for controlling a video recording machine of Claim 58 in which the recording media position indicator is graduated according to position of the recording media within a program segment.

25 60. The process for controlling a video recording machine of Claim 58 additionally comprising storing indexes of video material recorded on the recording media in a memory.

61. The process for controlling a video recording machine of Claim 60 additionally comprising including a title of a program recorded on the recording media and a time of recording the program in a data channel on the recording media and comparing the title of the program and the time of recording with the indexes in the memory and displaying an index for a selected one of the recording media based on a match between the program title and recording time on the selected one of the recording media with the indexes in said memory.

62. The process for controlling a video recording machine of Claim 61 additionally comprising generating an index during playback and recording with the selected one of the recording media and storing the generated index in the memory in the absence of a match between a title and recording time on the selected one of the recording media with the indexes in the memory.

63. A control system for a video recording machine, which comprises a controller for starting and stopping the video recording machine, for recording video information on recording media, and for playing recorded video information on recording media, a memory, a means connected to said memory for storing indexes of video material recorded on the recording media in said memory, the recording media include a data channel and said control system has a means for including a title of a program recorded on the recording media in the video recording machine in the data channel, said control system including a means for comparing the title of the program with indexes in said memory and displaying an index for a selected one of the recording media based on a match between the program title on the selected one of the recording media with the indexes in said memory.

64. The control system for a video recording machine of Claim 63 in which said system includes a means for generating an index during playback and recording with the selected one of the recording media and to store  
5 the generated index in said memory in the absence of a match between a title on the selected one of the recording media with the indexes in said memory.

65. The control system for a video recording machine of Claim 63 in which the video recording machine  
10 is a video cassette recorder and the recording media are video tape.

66. A system comprising the control system for a video recording machine of Claim 63 connected to a video recording machine.

15 67. A process for controlling a video recording machine, which comprises storing indexes of video material recorded on recording media in a memory, the recording media including a data channel, including a title of a program recorded on the recording media in  
20 the video recording machine in the data channel, comparing the title of the program with indexes in the memory and displaying an index for a selected one of the recording media based on a match between the program title on the selected one of the recording media with  
25 the indexes in said memory.

68. The process for controlling a video recording machine of Claim 67 additionally comprising generating an index during playback and recording with the selected one of the recording media and storing the generated  
30 index in the memory in the absence of a match between

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a title on the selected one of the recording media with the indexes in the memory.

69. A television schedule system, which comprises:  
a display,  
5 means connected to said display for displaying the television schedule on the display,  
said means for displaying a schedule being configured to allow selection by a user of a first number of desired channels for display of schedule information  
10 which is less than a second number of available channels,  
a programmable tuner connected to said means for displaying a schedule,  
said programmable tuner being configured to follow said first number of desired channels when said  
15 television schedule is shown on said display in response to a channel up or channel down command, and said programmable tuner being configured to follow the second number of available channels in the absence of said television schedule on said display in response to a  
20 channel up or channel down command.

70. The television schedule system of Claim 69 additionally comprising means connected to the display for providing a cursor with the television schedule on the display, and in which said means for displaying a  
25 schedule is further configured so that the cursor follows a change in a channel to which said programmable tuner is tuned.

71. The television schedule system of Claim 69 in which said means for displaying the schedule is  
30 configured to show the schedule as an array, a portion of the array corresponding to a given period of time, said means for displaying the schedule being further

configured to display a continuity icon with programs contained only in part within the given period of time.

72. The television schedule system of Claim 69 in which said means for displaying the schedule is further  
5 configured to display programs with a different appearance to indicate recording status.

73. The television schedule system of Claim 72 in which said means for displaying the schedule is configured to display the programs with different  
10 appearances to show that a program has been selected for recording, is presently being recorded, has been recorded, and was mis-recorded.

74. The television schedule system of Claim 69 in which said means for displaying the schedule is further  
15 configured to display a linking icon with programs that are to be recorded in combination with other programs.

75. The television schedule system of Claim 69 in which said means for displaying the schedule is further configured to display a time status indicator delineating  
20 past time from future time.

76. The television schedule system of Claim 69 in which said means for displaying a schedule is further configured to display a program note overlay for a selected program on a portion of the display.

25 77. The television schedule system of Claim 76 in which said means for displaying a schedule is further configured to display the program note overlay in different locations to avoid masking a title of the selected program.

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78. The television schedule system of Claim 69 in which said means for displaying a schedule is further configured to display a channel to which said television tuner is tuned with a different appearance than other  
5 channels in the schedule.

79. The television schedule system of Claim 78 in which said means for displaying a schedule is further configured so that the cursor follows a change in a channel to which said television tuner is tuned.

10 80. The television schedule system of Claim 69 in which said means for displaying a schedule is further configured to display alternatively a schedule for a plurality of channels covering a first time period or a schedule for a single channel covering a second time  
15 period.

81. The television schedule system of Claim 69 additionally comprising a television set connected to said means for displaying a schedule and in which said means for displaying a schedule is further configured  
20 to display an overlay containing information on a television program being shown on said television set when a channel being shown on the television set is changed.

82. The television schedule system of Claim 81 in  
25 which the information on the television program includes program title, name of television service, channel number, date and time.

83. The television schedule system of Claim 82 in which said means for displaying a schedule is further  
30 configured to provide an alternate overlay including a

program note for the television program being shown on said television set.

84. The television schedule system of Claim 69 additionally comprising a recording device connected to  
5 said means for displaying a schedule and in which said means for displaying a schedule is further configured to display information about recording in response to a user command to record a program.

85. The television schedule system of Claim 69  
10 additionally comprising a recording device connected to said means for displaying a schedule and in which said means for displaying a schedule is further configured to display an index of recorded programs.

86. The television schedule system of Claim 85 in  
15 which the index of recorded programs includes an identification by title.

87. The television schedule system of Claim 85 in which the index of recorded programs includes a pointer showing current location on a recording medium in said  
20 recording device.

88. The television schedule system of Claim 87 in which the pointer is graduated in segments corresponding to each recorded program on the recording medium, and linearly with respect to position in each segment.

25 89. The television schedule system of Claim 85 additionally comprising a memory for the index connected to said means for displaying a schedule, said memory having a capacity to store an index for a plurality of recording media for said recording device.



90. The television schedule system of Claim 89 in which the recording media include a data channel and said recording device is configured to include a title of a program recorded on the recording media in the data channel, said means for displaying a schedule is further configured to compare a title in the data channel with the index in said memory and to display an index for the recording medium in said recording device based on a match of the title on the recording medium with the index in the memory.

91. The television schedule system of Claim 90 in which said means for displaying a schedule is further configured to generate an index during playback and recording with the recording medium and to store the index in said memory in the absence of a match between a title on the recording medium with the index in the memory.

92. A process for operating a television schedule system, which comprises:  
selecting a first number of desired channels for display of schedule information which is less than a second number of available channels,  
displaying the schedule information on a display, following the first number of desired channels when the schedule information is shown on the display in response to a channel up or channel down command, and following the second number of available channels in the absence of the television schedule on the display in response to a channel up or channel down command.

93. The process of Claim 92 in which the schedule information is shown as a portion corresponding to a given period of time, the process additionally comprising

displaying a continuity icon with programs contained only in part within the given period of time.

94. The process of Claim 92 in which programs in the schedule information are displayed with a different appearance to indicate recording status.

95. The process of Claim 94 in which the programs are displayed with different appearances to show that a program has been selected for recording, is presently being recorded, has been recorded, and was mis-recorded.

96. The process of Claim 92 additionally comprising displaying a linking icon with programs that are to be recorded in combination with other programs.

97. The process of Claim 92 additionally comprising displaying a time status indicator delineating past time from future time.

98. The process of Claim 92 additionally comprising displaying a program note overlay for a selected program on a portion of the schedule information.

99. The process of Claim 98 in which the program note overlay is displayed in different locations to avoid masking a title of the selected program.

100. The process of Claim 92 additionally comprising tuning a television tuner to a channel and displaying the channel to which said television tuner is tuned with a different appearance than other channels in the schedule information.

101. The process of Claim 37 additionally comprising tuning a television tuner to a channel and in which a cursor follows a change in a channel to which the television tuner is tuned.

5 102. The process of Claim 92 in which the schedule information is alternatively displayed as a schedule for a plurality of channels covering a first time period or a schedule for a single channel covering a second time period.

10 103. The process of Claim 92 additionally comprising displaying an overlay containing information about a television program being shown on a television set connected to the television schedule system when a channel being shown on the television set is changed.

15 104. The process of Claim 103 in which the information on the television program includes program title, name of television service, channel number, date and time.

20 105. The process of Claim 104 additionally comprising providing an alternate overlay including a program note for the television program being shown on said television set.

25 106. The process of Claim 92 additionally comprising displaying information about recording in response to a user command to record a program.

107. The process of Claim 92 additionally comprising connecting a recording device to the schedule system and displaying an index of recorded programs.

108. The process of Claim 107 in which the index of recorded programs includes an identification by title.

109. The process of Claim 107 in which the index of recorded programs includes a pointer showing current  
5 location on a recording medium in the recording device.

110. The process of Claim 109 in which the pointer is graduated in segments corresponding to each recorded program on the recording medium, and linearly with respect to position in each segment.

10 111. The process of Claim 107 additionally comprising storing an index for a plurality of recording media for the recording device in a memory.

112. The process of Claim 111 in which the recording media include a data channel and a title of  
15 a program recorded on the recording media is included in the data channel, the process additionally comprising comparing a title in the data channel with the index in the memory and displaying an index for a recording medium in the recording device based on a match of the title  
20 on the recording medium with the index in the memory.

113. The process of Claim 112 in which an index is generated during playback and recording with the recording medium and stored in the memory in the absence of a match between a title on the recording medium with  
25 the index in the memory.

11:00 AM		11:30 AM		12:00 PM	
JUDGE(PART 1)		JUDGE(PART 2)		AT NOON	
GOLDEN GIRLS		NEWS		INSIDE EDITION	
YOUNG & RESTLESS		LOVING		NEWS	
PERFECT STRA		SESAME STREET		ALL MY CHILD	
ALL MY CHILDREN		NEWS		MOVIE	
EVERYDAY		LORNE GREEN'S WORLD OF S		FUGITIVE	
NEWS		NEWS		LUNCH BOX	
WALT DISNEY PRESENTS		JANE WALLACE		FRUGAL GOURM	
MOVIE		KNTV-FOX		CBL 2	
TNT		11:25A		TUE APR 3	
CH 2		11:00 AM		11:30 AM	

FIG. -1

SUBSTITUTE SHEET

		11:00 AM		11:30 AM		12:00 PM	
32	2	JUDGE(PART 1)		JUDGE(PART 2)		AT NOON	
	4	GOLDEN GIRLS		NEWS		INSIDE EDITION	
	5	YOUNG & RESTLESS <sup>26</sup>		NEWS <sup>26</sup>		NEWS <sup>26</sup>	
	7	PERFECT STRA		LOVING		ALL MY CHILD	
	9	SESAME STREET <sup>26</sup>					
	13	ALL MY CHILDREN				NEWS	
	44	EVERYDAY <sup>26</sup>				MOVIE	
	A&E	LORNE GREEN'S WORLD OF S				FUGITIVE	
	CNN	NEWS				NEWS	
	DIS	WALT DISNEY PRESENTS				LUNCH BOX	
12	LIF	JANE WALLACE				FRUGAL GOURM	
	TNT	MOVIE <sup>26</sup>					
	CH 2	KNTV-FOX		CBL 2		11:25A	
						TUE APR 3	

FIG.-2

11:00 AM		11:30 AM	12:00 PM
[2]	JUDGE (PART 1)	JUDGE (PART 2)	AT NOON <sup>32</sup>
[4]	GOLDEN GIRLS	NEWS <sup>26</sup>	INSIDE EDITION
[5]	YOUNG & RESTLESS		NEWS <sup>26</sup>
[7]	PERFECT STRA	LOVING	ALL MY CHILD
[9]	SESAME STREET		
[13]	ALL MY CHILDREN		NEWS <sup>26</sup>
[44]	EVERYDAY <sup>26</sup>		MOVIE
[A&E]	LORNE GREEN'S WORLD OF S		FUGITIVE
[CNN]	NEWS		NEWS
[DIS]	WALT DISNEY PRESENTS		LUNCH BOX
[LIF]	JANE WALLACE		FRUGAL GOURM
[TNT]	MOVIE <sup>26</sup>		
[CH 2]	[KNTV-FOX]	[CBL 2]	

SUBSTITUTE SHEET

FIG. -3

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PENDING RECORDINGS	RECORDED PROGRAMS	LINKED TITLES	ON GRID PROG
NEWS	CH 4	4/3 11:30A	:30
ROSEANNE	CH 13	4/3 9:00P	:30
ALL MY CHILDREN	CH 7	4/4 12:00P	1:00
MACNEIL, LEHRER	CH 9	4/4 6:30P	1:00
QUANTUM LEAP	CH 4	4/5 10:00P	1:00
NOVA	CH 9	4/5 8:00P	1:00
MOVIE: ALIEN NATION	HBO	4/5 9:00P	2:00
ALL MY CHILDREN	CH 7	4/6 12:00P	1:00
CHEERS	CH 5	4/6 7:00P	:30
MOVIE: SUMMER JOB	SHO	4/6 9:00P	2:00
NBA BASKETBALL	CH 5	4/7 4:00P	?
		SP	EP




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SUBSTITUTE SHEET

FIG. -4



5/24

	11:00 AM	11:30 AM	12:00 PM
[2]	JUDGE(PART 1)	JUDGE(PART 2)	AT NOON
[4]	GOLDEN GIRLS	NEWS <sup>26</sup>	INSIDE EDITION
[5]	YOUNG & RESTLESS		NEWS <sup>26</sup>
[7]	PERFECT STRA	LOVING	ALL MY CHILD
[9]	SESAME STREET <sup>26</sup>		
[13]	ALL MY CHILDREN		NEWS <sup>26</sup>
[44]	EVERYDAY		MOVIE
[A&E]	LORNE GREEN'S WORLD OF S		FUGITIVE
[CNN]	NEWS <sup>26</sup>		NEWS 
[DIS]	WALT DISNEY PRESENTS		LUNCH BOX
[LIF]	JANE WALLACE		FRUGAL GOURM
[TNT]	 MOVIE <sup>26</sup>		
[CH 2]	[KNTV-FOX]	[CBL 2]	[11:25A] [TUE APR 3]

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SUBSTITUTE SHEET

FIG. -5

6/24

	11:00 AM	11:30 AM	12:00 PM
2	JUDGE(PART 1)	JUDGE(PART 2)	AT NOON
4	GOLDEN GIRLS	NEWS <sup>26</sup>	INSIDE EDITION
5	YOUNG & RESTLESS		NEWS <sup>26</sup>
7	PERFECT STRA	LOVING	ALL MY CHILD
9	SESAME STREET <sup>26</sup>		
13	ALL MY CHILDREN		NEWS <sup>26</sup>
44	EVERYDAY <sup>26</sup>		MOVIE
A&E	LORNE GREEN'S WORLD OF S		FUGITIVE
CNN	NEWS	NEWS	NEWS
DIS	DOROTHY BRINGS SOPHIA'S SISTER (NANCY WALKER) OVER FROM SICILY AS A BIRTHDAY SURPRISE		
LIF			
TNT			
CH 2	KNTV-FOX	CBL 2	11:25A
			TUE APR 3

32

24

20

SUBSTITUTE SHEET

FIG. --6

WHAT'S NEXT ON CHANNEL 2			
11:00 A	JUDGE (PART 1)		
11:30 A	JUDGE (PART 2)		
12:00 P	AT NOON		
1:00 P	MOVIE: ANATOMY OF A SEDUCTION		
3:00 P	ALVIN AND THE CHIPMUNKS		
3:30 P	SUPER MARIO BROS. SUPER SHOW		
4:00 P	CHIP'N DALES RESCUE RANGERS		
4:30 P	DUCKTALES		
5:00 P	SILVER SPOONS		
5:30 P	THREE'S COMPANY		
6:00 P	WHO'S THE BOSS		
6:30 P	MAMA'S FAMILY		
7:00 P	CHEERS		
CH 2	KNTV-FOX	CBL 2	11:25A TUE APR 3

60

58

22

62

FIG. -7

8/24

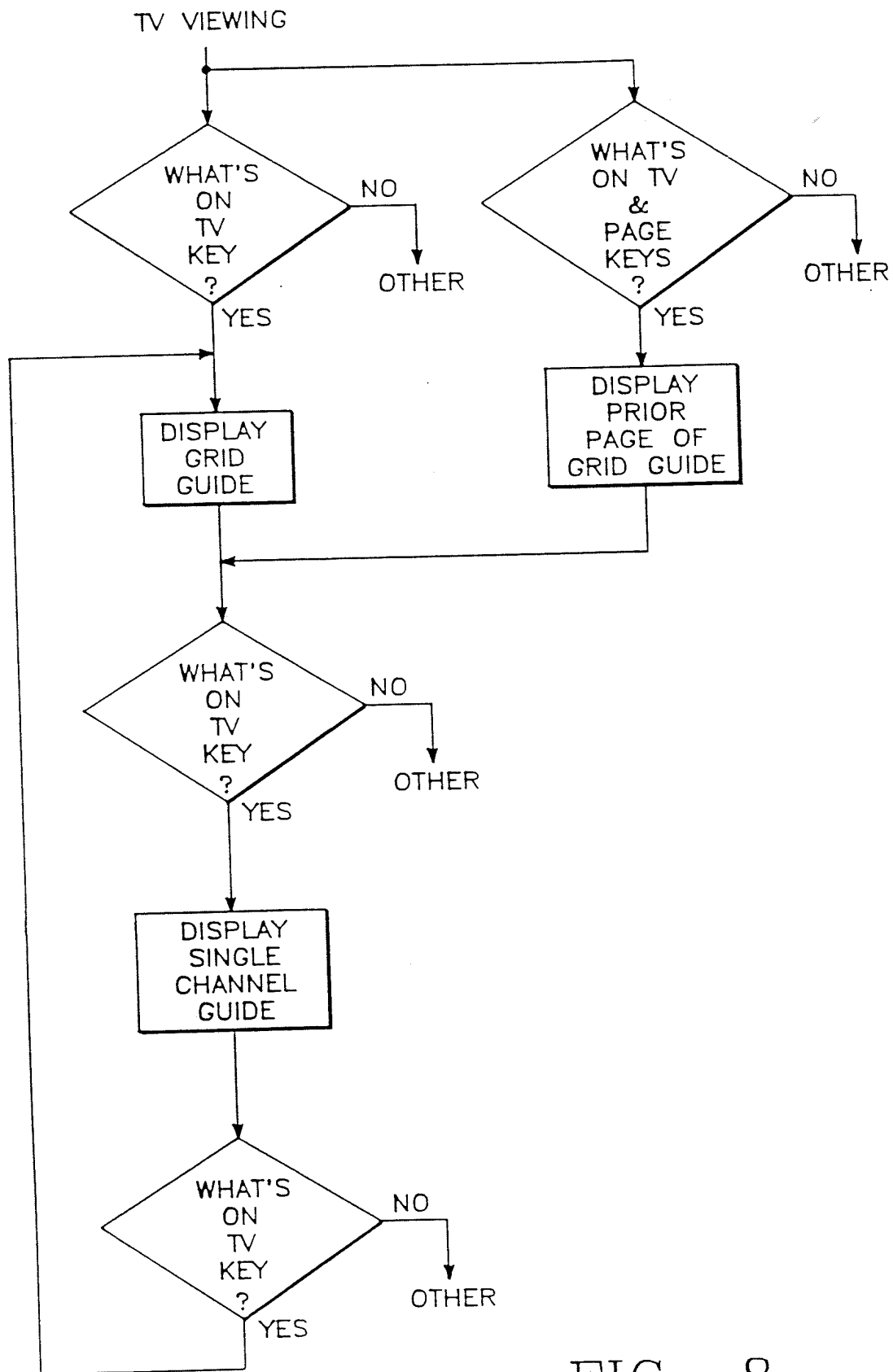


FIG.-8

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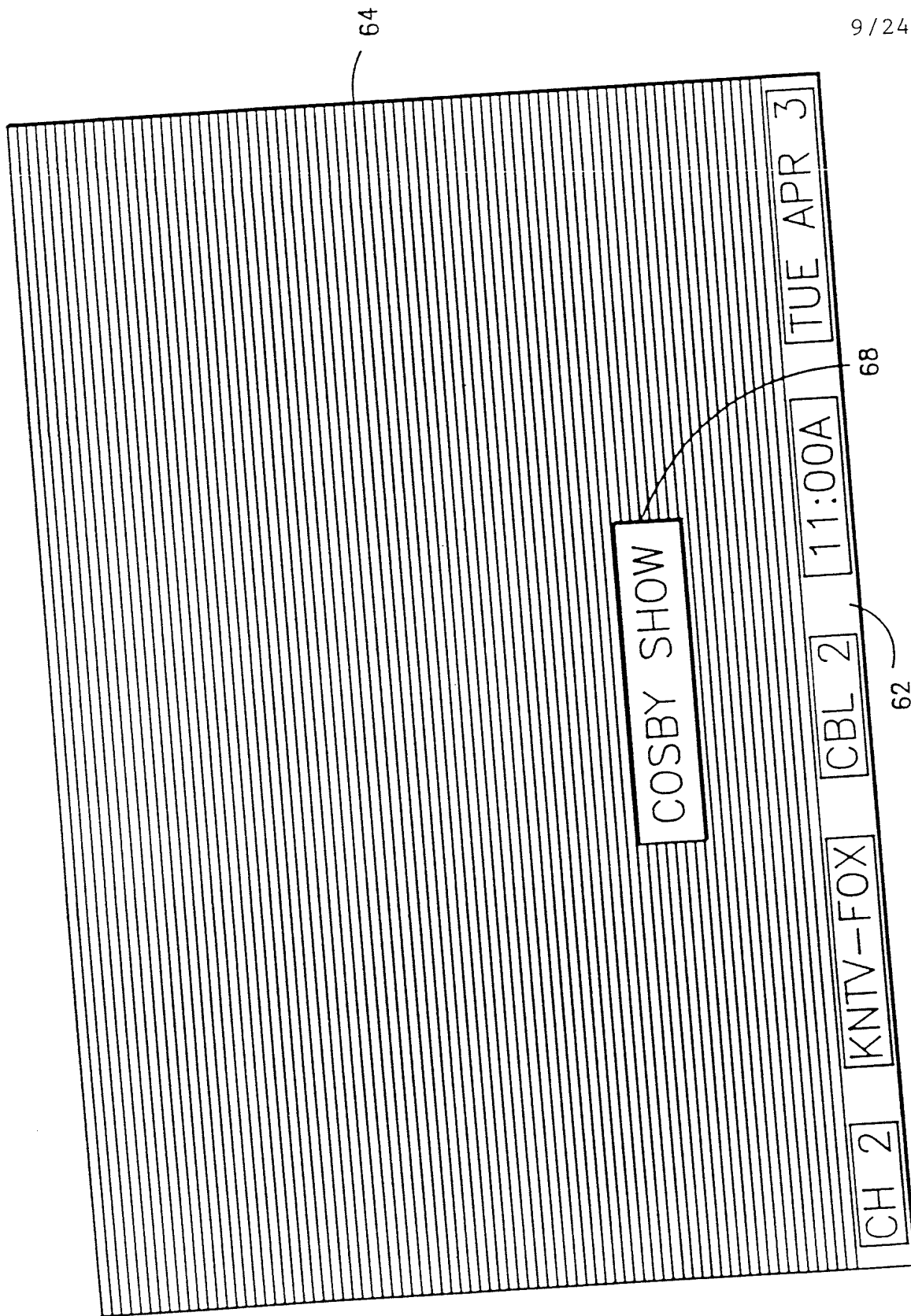


FIG.-9

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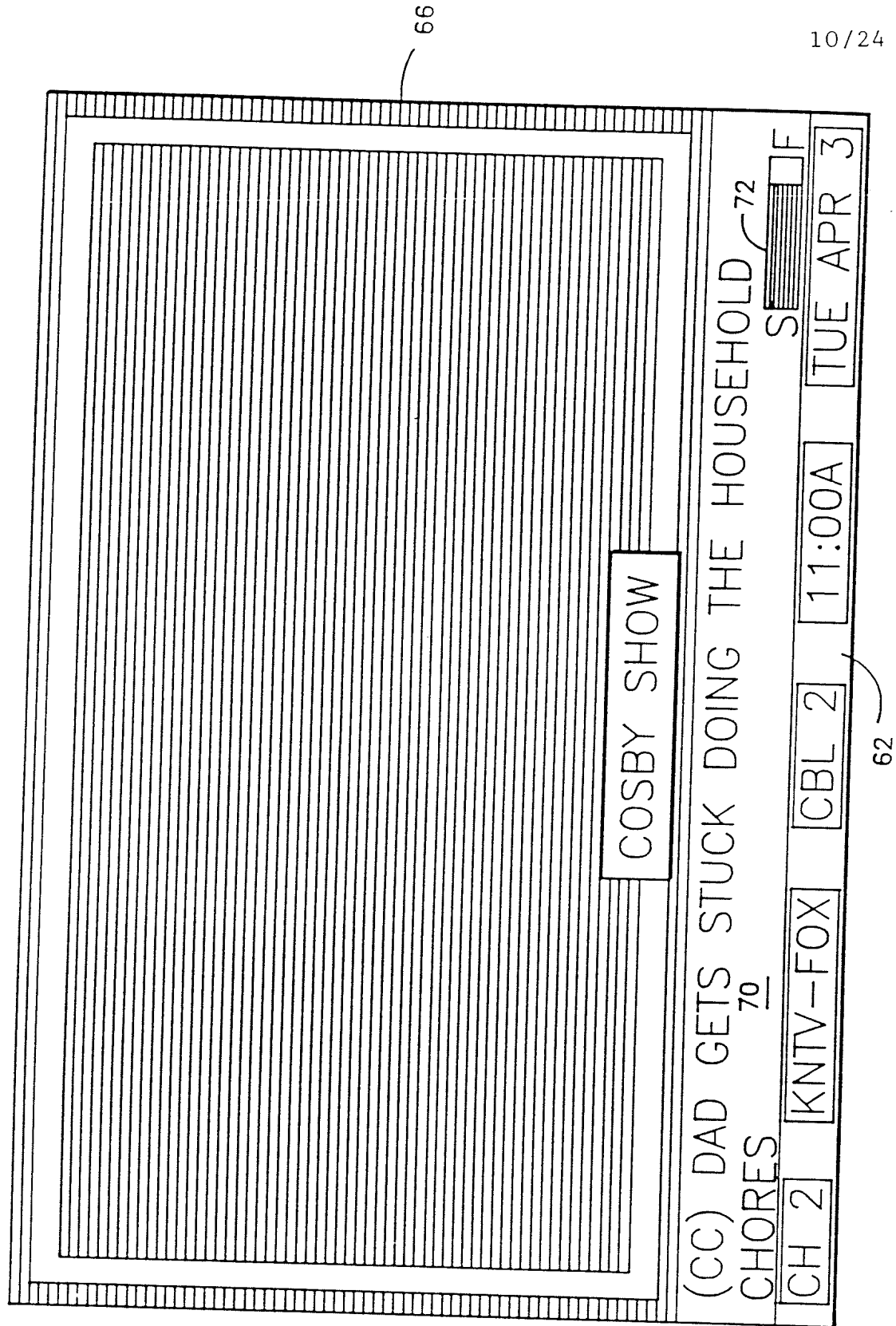


FIG. -10

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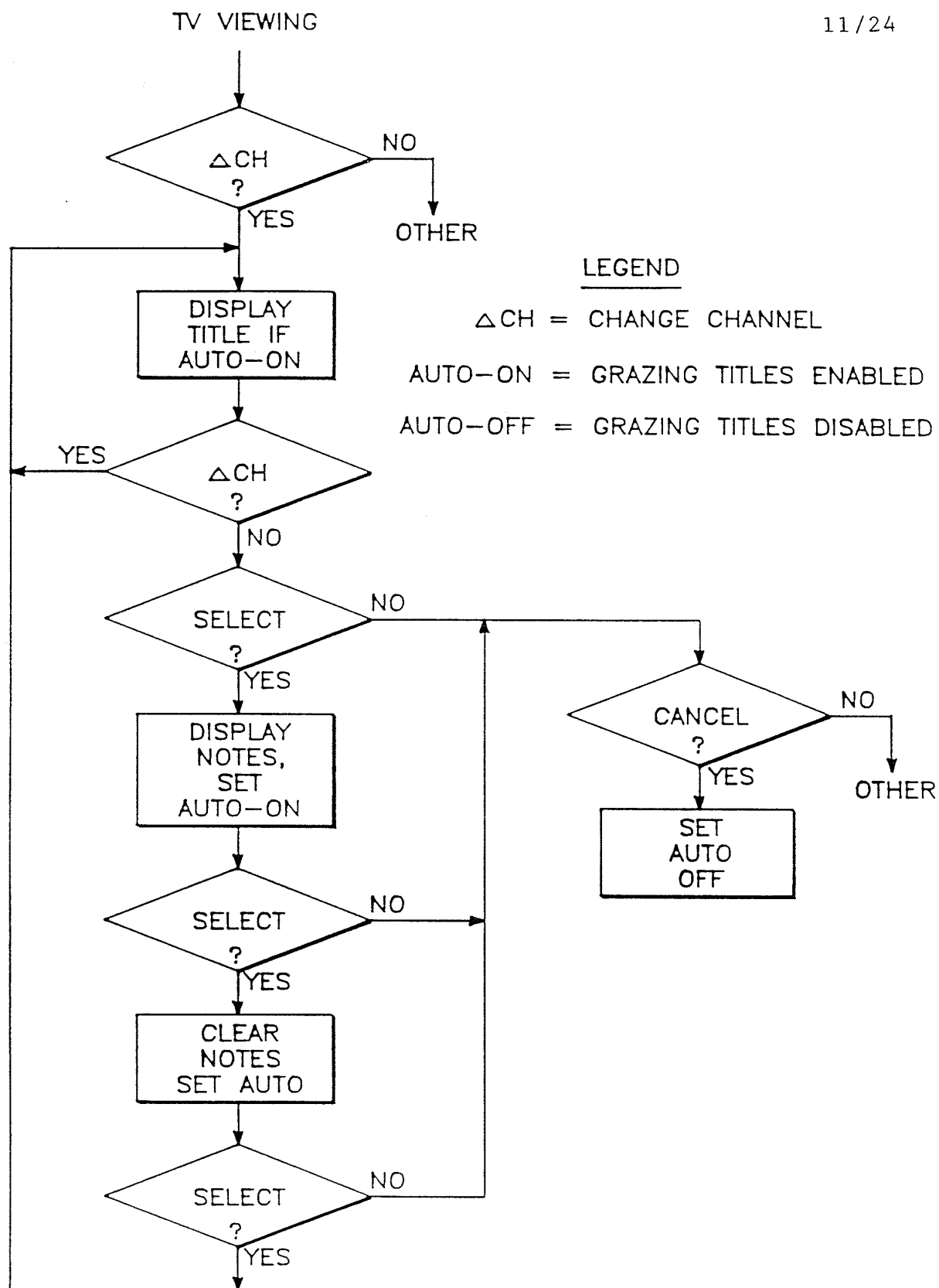


FIG.-11

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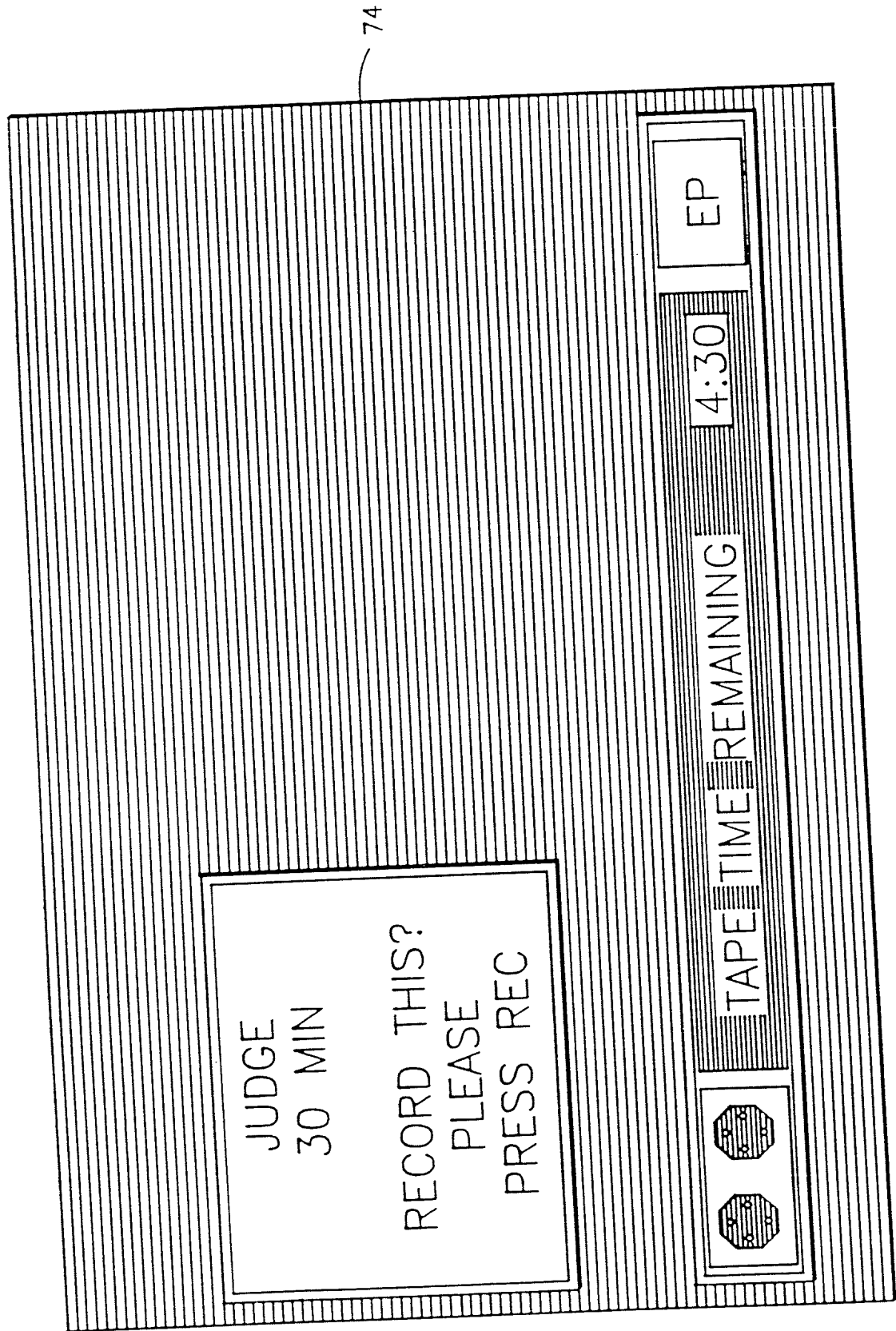


FIG. -12



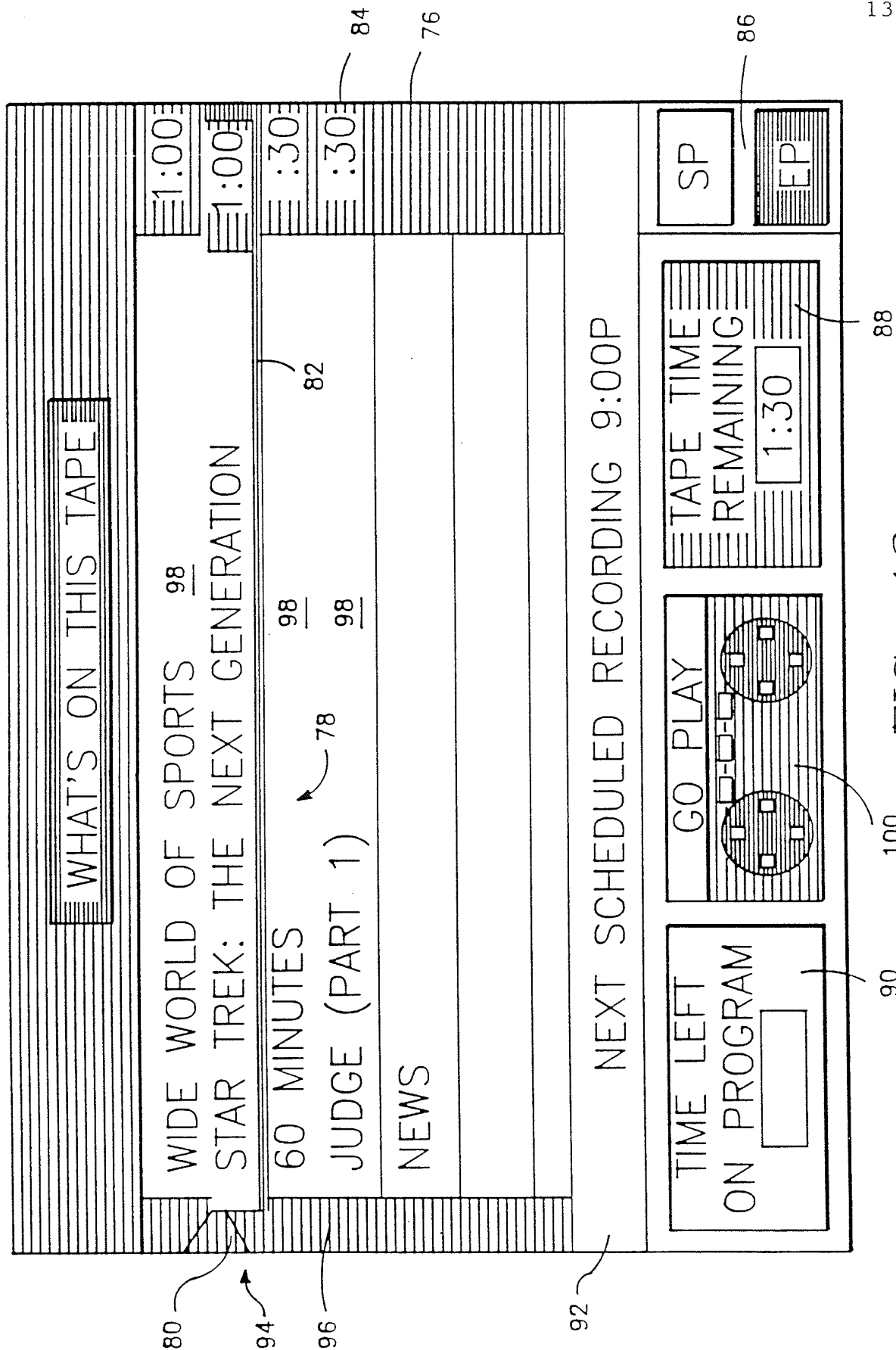


FIG. -13

THEMES

MOVIES <sup>106</sup>	SPORTS <sup>106</sup>	SPECIALS <sup>106</sup>	TV FARE <sup>106</sup>
G <sup>106</sup>	PG <sup>106</sup>	* * * * * <sup>106</sup>	* * * * * <sup>106</sup>
NR	R	* *	*

112
110

ALL MOVIES <sup>108</sup>	FOREIGN FILMS
ACTION/ADVENTURE <sup>108</sup>	SUSPENSE/HORROR
BIOGRAPHY/HISTORY <sup>108</sup>	MUSICAL <sup>108</sup>
COMEDY	SATIRE
DOCUMENTARY	SOCIAL ISSUES
DRAMA/ROMANCE	SCIENCE FICTION
FAMILY/CHILDREN <sup>108</sup>	SCIENCE/NATURE
FANTASY/ANIMATION	WESTERN

104
108

SUBSTITUTE SHEET

FIG. - 14

112

THEMES	
SPORTS	TV FARE
MOVIES	SPECIALS
PROFESSIONAL	CHAMPIONSHIP
COLLEGIATE	
ALL SPORTS	GOLF
AUTORACING	HORSERACING
BASEBALL	OLYMPICS
BASKETBALL	TENNIS
BOATRACING	TRACK/FIELD
BOWLING	SPORTS ANTHOLOGY
BOXING	SPORTS NEWS/COMMENT
FOOTBALL	OTHER SPORTS
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

FIG. - 15

THEMES

MOVIES

SPECIALS

TV FARE

LIVE

FIRST RUN

RERUN

ALL SPECIALS	NEWS
AWARD/PAGEANTS	PICK OF THE WEEK
COMEDY	PIPELINE PROGRAMS
DRAMA	BULLETIN BOARD
ENTERTAINMENT	
FAMILY/CHILD	
HOLIDAY	
MINI-SERIES	
<div></div>	<div></div>

FIG. - 16

THEMES

MOVIES

SPECIALS

TV FARE

LIVE

FIRST RUN

RERUN

ALL TV FARE	ETHNIC/DEVOTIONAL
ACTION/ADVENTURE	GAME SHOWS
ANIMATION/CARTOON	HEALTH/EXERCISE
BUSINESS/FINANCE	NEWS/INFORMATION
CHILDREN	MUSIC
COMEDY/VARIETY	SCI FI/HORROR
DRAMA/SUSPENSE	SCIENCE/NATURE
EDUCATIONAL	TALK SHOWS
<div></div>	<div></div>

} 11

FIG. - 17

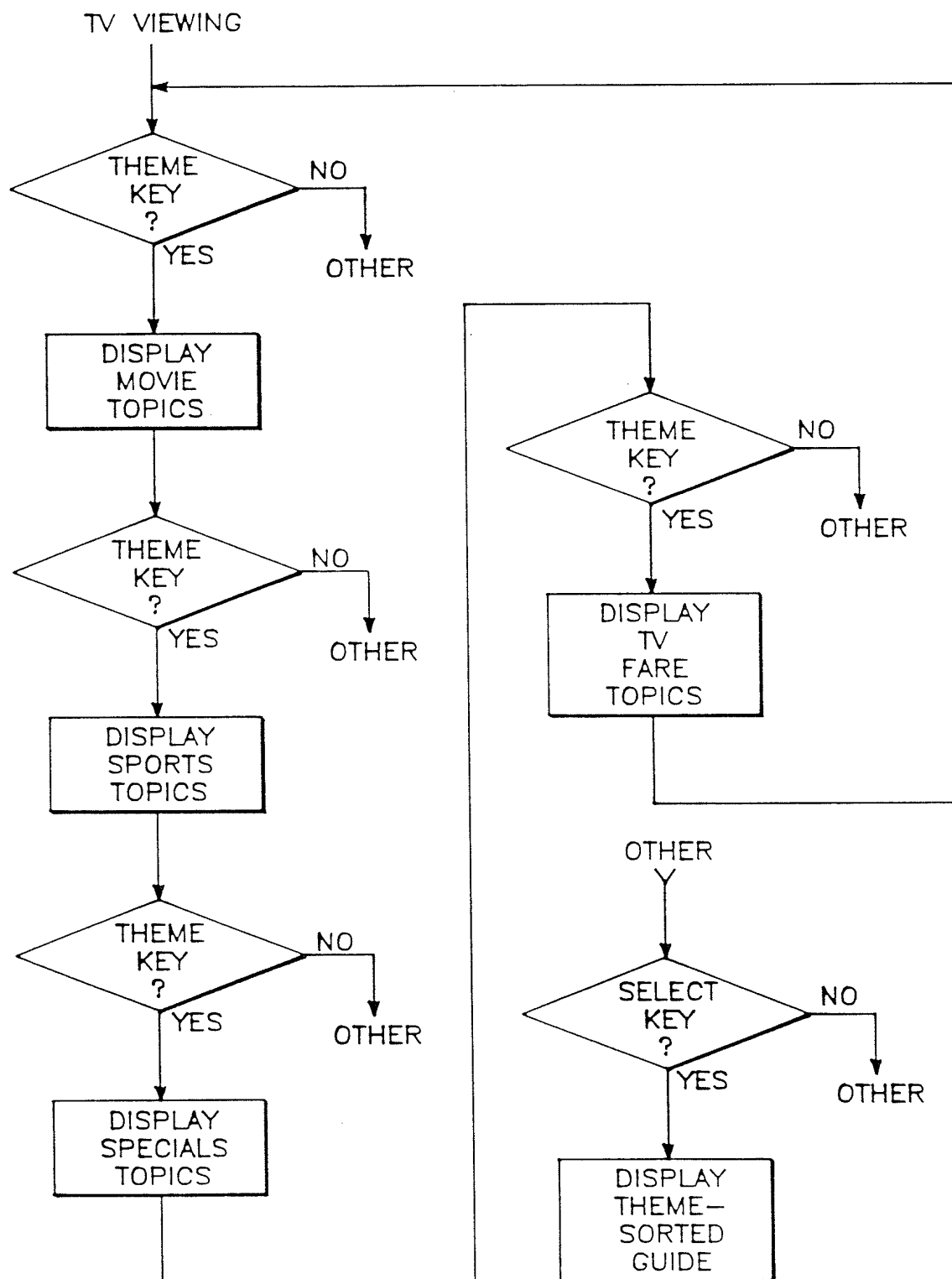


FIG.-18

19/24

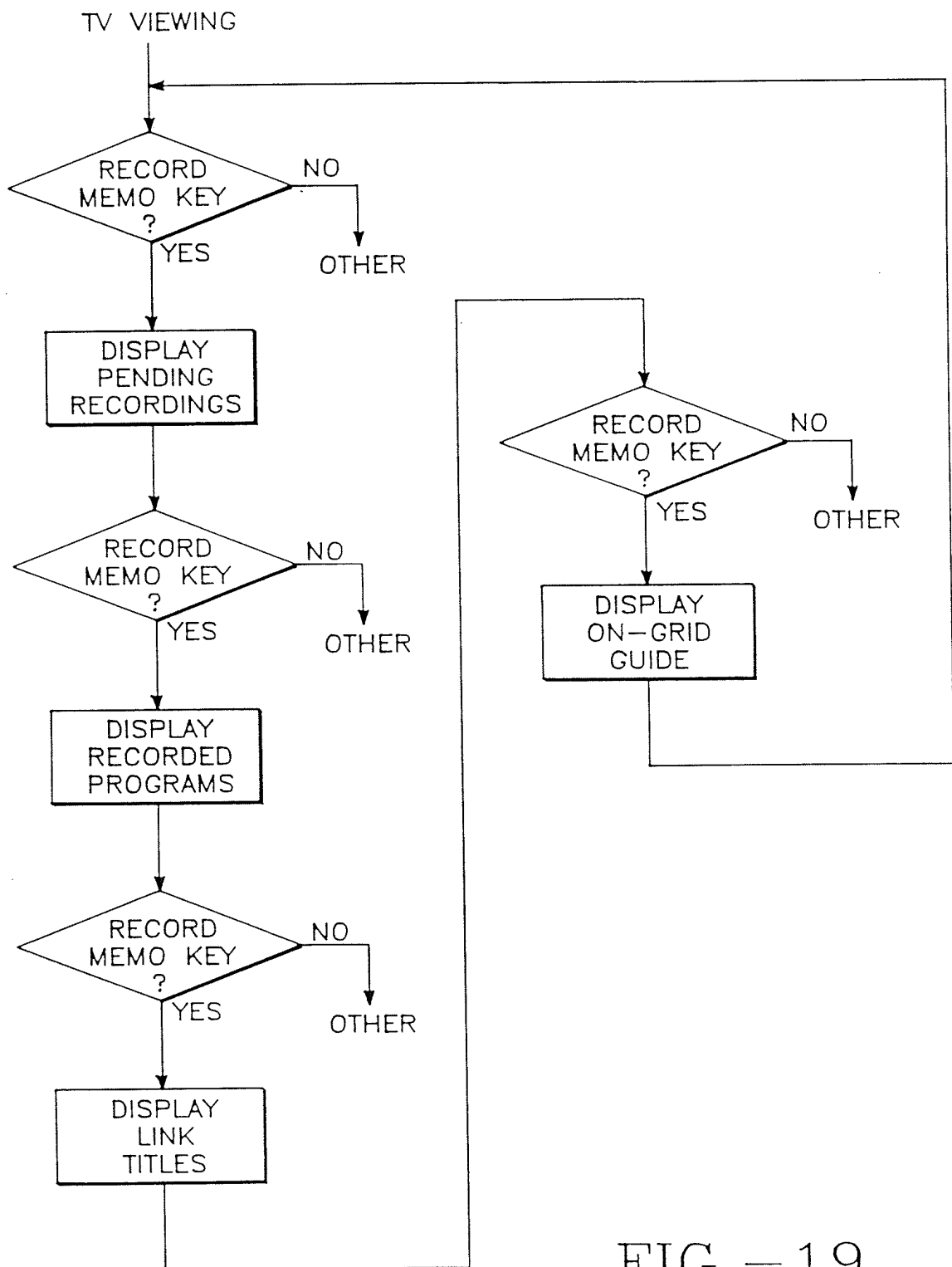


FIG.-19

MY		CHANNEL CUSTOMIZATION										PAGE 1		
2	KTVU-2	14	WGN	26	CSPAN									
4	KICU-36	15	PPVW	27	MAX									
5	KRON-4	16	KVOF-38	28	CSPAN									
7	KPIX-5	17	WTBS	29	EDUC									
9	KSTS-48	18	KCSM-60	30	DIS									
20	KGO -7	19	KTSF-26	31	VH-1									
44	KTEH-54	20	KOFY-20	32	SHO									
HBO	KQED-9	21	TRVL	33	CNN									
SHO	KDTV-14	22	CBN	34	ESPN									
CNN	KNTV-11	23	CBB	35	ELIF									
DIS	KBHK-44	24	BDSS	36	HBO									
ESPN	KQEC-32	25	BARC	37	GALA									
USE SELECT TO CHANGE STATUS:												MY	OFF	ON

SUBSTITUTE SHEET

FIG.-20



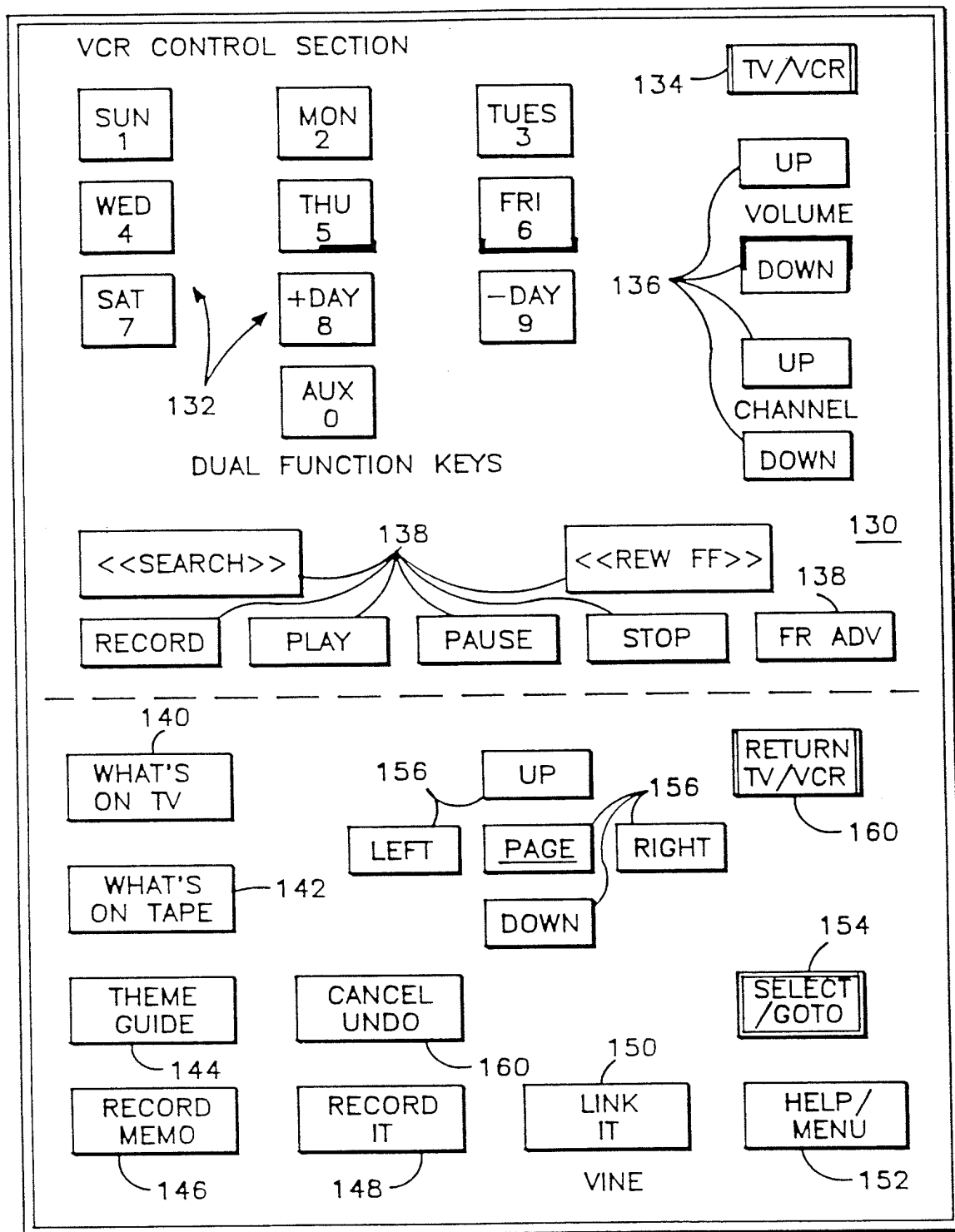


FIG.-21

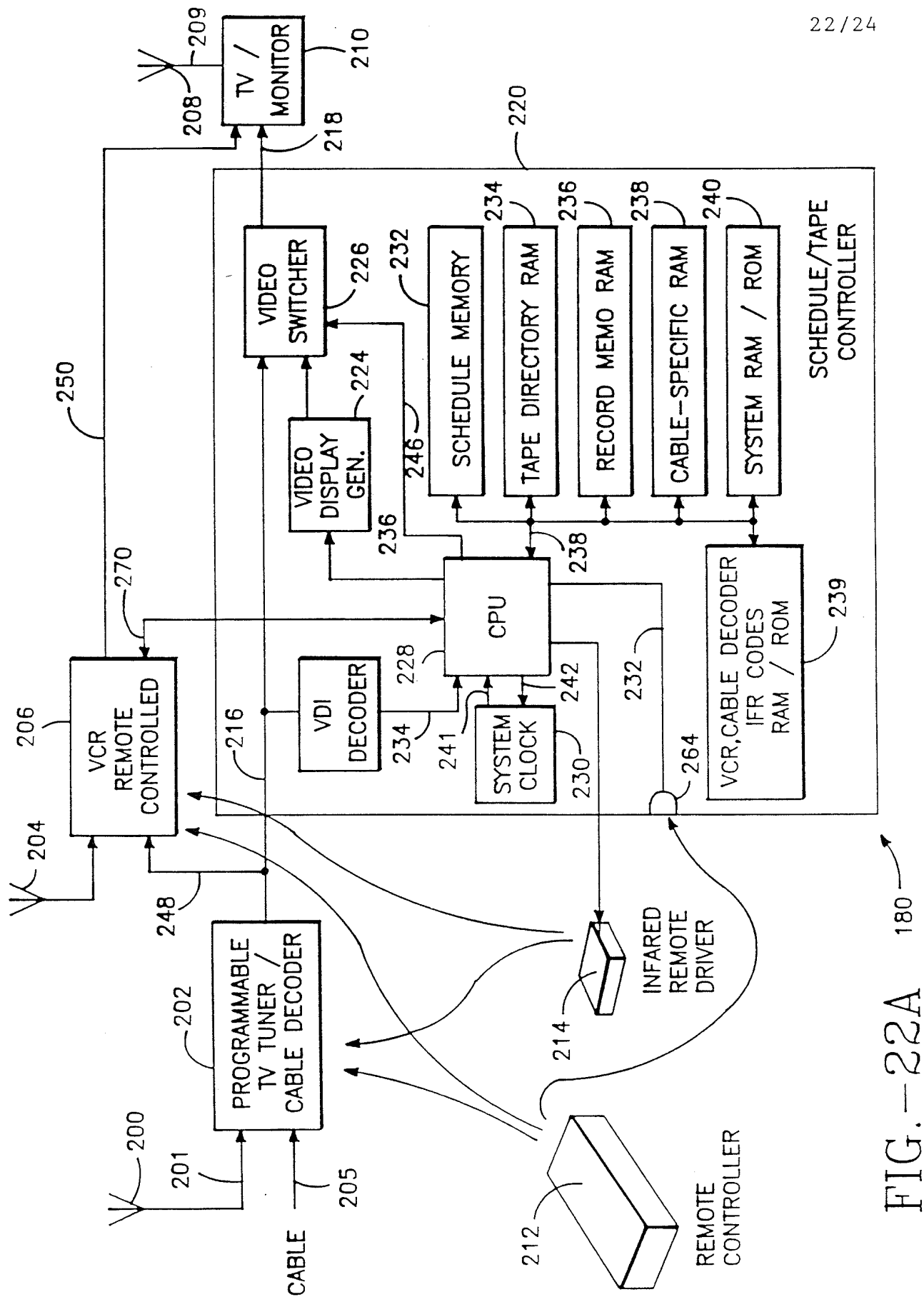


FIG. -22A

SUBSTITUTE SHEET

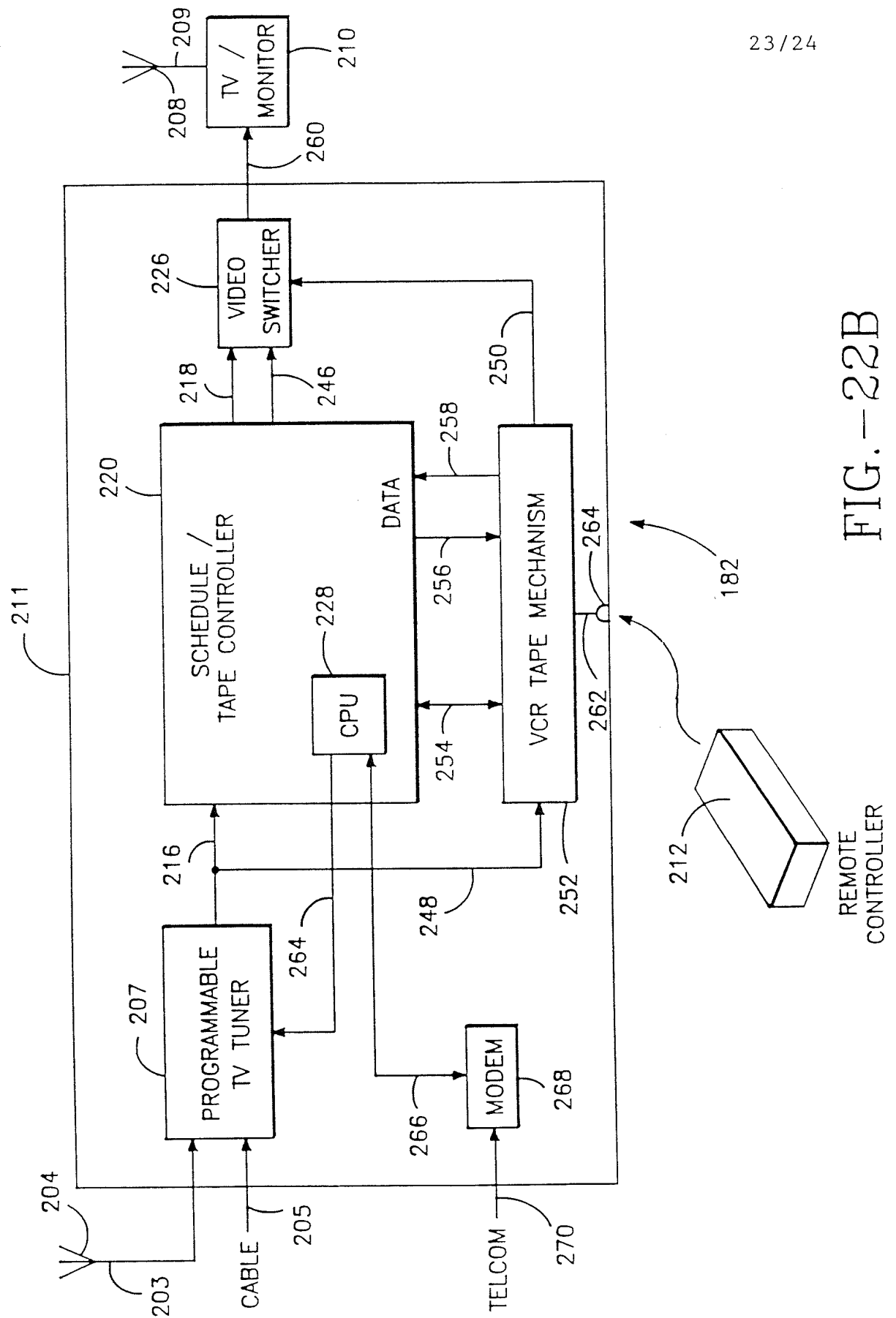


FIG. -22B

PENDING RECORDINGS

RECORDED PROGRAMS

LINKED TITLES

ON GRID PROG

ROOTS	CH 44 8:00 P
LUCY	
49ER'S FOOTBALL	
TWIN PEAKS	
U.S. OPEN GOLF	
LUCY (TWO)	CH 36 4:30 P SUSPENDED

TO CANCEL SELECTION, USE CANCEL/UNDO  
TO SUSPEND SELECTION, USE SELECT

19

47

FIG. - 23

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/06367

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC(5): HO4N 5/76 U.S. CL.: 358/335																							
<b>II. FIELDS SEARCHED</b> <div style="text-align: right; font-size: small;">Minimum Documentation Searched <sup>7</sup></div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; text-align: left; padding: 5px;">Classification System</th> <th style="text-align: left; padding: 5px;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px;">U.S.</td> <td style="padding: 5px;">358/335, 310, 86, 186 360/33.1, 14.1</td> </tr> </table> <div style="text-align: center; font-size: x-small; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div>			Classification System	Classification Symbols	U.S.	358/335, 310, 86, 186 360/33.1, 14.1																	
Classification System	Classification Symbols																						
U.S.	358/335, 310, 86, 186 360/33.1, 14.1																						
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; text-align: left; padding: 5px;">Category <sup>*</sup></th> <th style="width: 70%; text-align: left; padding: 5px;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 20%; text-align: left; padding: 5px;">Relevant to Claim No. <sup>13</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,847,696 (MATSUMOTO ET AL.) 11 July 1989. See figure 10 and Column 9, lines 22-50</td> <td style="vertical-align: top; padding: 5px;">1-50</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,841,132 (KAJITANI ET AL.) 20 June 1989. See figure 8 and column 6, lines 5-61.</td> <td style="vertical-align: top; padding: 5px;">1-50</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,908,713 (LEVINE) 13 March 1990. See figure 2 and lines 52, Column 1 to line 45 Column 2.</td> <td style="vertical-align: top; padding: 5px;">51-68</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,750,036 (MARTINEZ) 07 June 1988. See figure 14 and column 24, lines 14-58.</td> <td style="vertical-align: top; padding: 5px;">51-68</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 4,706,121 (YOUNG) 10 November 1987. See figure 3 and column 3, lines 34-52.</td> <td style="vertical-align: top; padding: 5px;">69-113</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y,P</td> <td style="padding: 5px;">US, A, 4,977,455 (YOUNG) 11 December 1990. See figure 1 and Column 2, line 68 to Column 3, line 57.</td> <td style="vertical-align: top; padding: 5px;">69-113</td> </tr> </table>			Category <sup>*</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	Y	US, A, 4,847,696 (MATSUMOTO ET AL.) 11 July 1989. See figure 10 and Column 9, lines 22-50	1-50	Y	US, A, 4,841,132 (KAJITANI ET AL.) 20 June 1989. See figure 8 and column 6, lines 5-61.	1-50	Y	US, A, 4,908,713 (LEVINE) 13 March 1990. See figure 2 and lines 52, Column 1 to line 45 Column 2.	51-68	Y	US, A, 4,750,036 (MARTINEZ) 07 June 1988. See figure 14 and column 24, lines 14-58.	51-68	Y	US, A, 4,706,121 (YOUNG) 10 November 1987. See figure 3 and column 3, lines 34-52.	69-113	Y,P	US, A, 4,977,455 (YOUNG) 11 December 1990. See figure 1 and Column 2, line 68 to Column 3, line 57.	69-113
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Y	US, A, 4,908,713 (LEVINE) 13 March 1990. See figure 2 and lines 52, Column 1 to line 45 Column 2.	51-68																					
Y	US, A, 4,750,036 (MARTINEZ) 07 June 1988. See figure 14 and column 24, lines 14-58.	51-68																					
Y	US, A, 4,706,121 (YOUNG) 10 November 1987. See figure 3 and column 3, lines 34-52.	69-113																					
Y,P	US, A, 4,977,455 (YOUNG) 11 December 1990. See figure 1 and Column 2, line 68 to Column 3, line 57.	69-113																					
<div style="display: flex; justify-content: space-between; font-size: x-small;"> <div style="width: 60%;"> <p><sup>*</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 35%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"G" document member of the same patent family</p> </div> </div>																							
<b>IV. CERTIFICATION</b> <table style="width: 100%;"> <tr> <td style="width: 60%;">           Date of the Actual Completion of the International Search   <div style="text-align: center; font-weight: bold; font-size: large;">20 DECEMBER 1991</div>           International Searching Authority   <div style="text-align: center;">ISA/US</div> </td> <td style="width: 40%; vertical-align: top;">           Date of Mailing of this International Search Report   <div style="text-align: center; font-weight: bold; font-size: x-large;">30 DEC 1991</div>           Signature of Authorized Officer  <div style="text-align: center;">               HUNG DANG           </div> </td> </tr> </table>			Date of the Actual Completion of the International Search  <div style="text-align: center; font-weight: bold; font-size: large;">20 DECEMBER 1991</div> International Searching Authority  <div style="text-align: center;">ISA/US</div>	Date of Mailing of this International Search Report  <div style="text-align: center; font-weight: bold; font-size: x-large;">30 DEC 1991</div> Signature of Authorized Officer <div style="text-align: center;">               HUNG DANG           </div>																			
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